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Philosophy of World Affairs

THE impressive appeal for national unity which Mr. Eden uttered at the annual banquet of the Royal Society of St. George contained many passages which should appeal particularly to the scientific worker. Recalling the rectorial address at St. Andrews in 1934 in which General Smuts emphasized the threat to freedom and self-government even then offered by the new experiments on the Continent, and pleading for freedom not as an abstract political ideal but as a creative force inspiring youth to noble action, Mr. Eden reminded his audience that to uphold our ideals and our conception of life called for an effort and a spirit comparable with that made by the totalitarian States for their own purposes. For our faith in freedom, in toleration, in justice, the rule of law and co-operation, we should be prepared to make every contribution in our favour.

The threat to freedom of thought and speech and action grows ever greater, and the danger to-day is that in those countries which cherish liberty and democracy, the organization of defence and a common front against aggression itself tends to develop threats to freedom, which are more insidious even if closely allied to those encountered in the totalitarian State itself.

This factor, to which Walter Lippmann directed attention in his striking book "The Good Society", renders it imperative that the common effort called for from the democratic nations shall have a moral basis. This is not only the surest corrective to the insidious tendency to love "bondage with ease than strenuous liberty", but also the firmest basis for national unity.

There are no two opinions as to the supreme importance of promoting international understanding and good will, nor at the present time as to the importance of rearmament. On all sides, any policy which will lead to an appeasement of national jealousies and relieve political tension is welcomed. It is another question, however, if the expedients adopted prove obstacles in the way of that mutual trust and respect for treaty obligations in the dealings of civilized peoples with one another, upon which alone, as the Covenant of the League proclaims, relations of justice and good will can be permanently established.

The internal success of the totalitarian States has already exposed very clearly their limitations and provoked serious doubts as to how much can be hoped for from planning even in a democratic State. It is not the least service of Walter Lippmann's study of collectivism that he shows clearly its dangers even in a democratic regime. Lippmann indeed contends that planning is impossible in a true democracy, and that it depends on the authoritarian principle, which is a rejection of the wisdom of experience and the acceptance of errors which previous generations had learnt to discard.

Lippmann's contention, however unpalatable as it may be to most schools of political thought, contains too much truth in it to be lightly disregarded. Mankind unquestionably has advanced in knowledge, in the mastery of Nature, in unity, and in personal security through a progressive emancipation from the bondage of authority, monopoly and special privilege. The scientific achievements which have confronted us with some of our acutest difficulties to-day, and which by some are regarded as compelling the establishment of authority, even as they extend its power and range, have indeed become possible only as scientific inquiry was emancipated from authority. Scientific workers already have before them uncomfortable examples of the decay of scientific thought under the authoritarian regime.

If it is by the removal of restraints, rather than by constraints, as Lippmann suggests, that men have been able to adapt themselves to the life of great societies, there is none the less no more vital problem confronting democracy than the selection of just those constraints which are essential to its security without endangering the freedom from which its vitality springs. Because to plan every detail, as in the totalitarian State, means death to individuality and progress, we are not to assume that planning has no place in a democracy. No municipality, no rural or urban community, could avoid disaster for long without some manifestation of the foresight and prevision implicit in the idea of planning. Water supply, food supply, health, transport, and even recreation, all demand a quantitative conception of the needs of a community, and an organized attempt to meet those needs.

What therefore is demanded that our planning shall have some conception of man's spiritual needs, some regard to moral values and be based on co-operation and legislation rather than command. It is the type and purpose of our planning that are vital, and the tragedy of to-day is that the effort being made to eliminate waste, to conserve national resources and to meet national needs, is so often dominated by ideas and purposes that threaten world disaster and violate the moral and spiritual needs of mankind.

Nowhere is this truer than in the international sphere, and Senor de Madariaga's recently published outline of a world commonwealth vividly attests this truth. The most urgent task, as he sees it, is to teach world opinion to appreciate that the only way out of chaos is to lay the foundation for a world community which might establish enduring peace, the inner nature of which is justice. Nationally, as internationally, the problem is fundamentally one of education. When all the resources of the totalitarian State are directed to the mass education of its citizens for nationalist purposes and individuality is warped or crushed, the chief hope of civilization lies in the education of public opinion elsewhere to the need for and possibilities of world co-operation, and in a way which may yet win the consent of the totalitarian regimes themselves.

Effective thinking on the part of the individual voter is indeed the final condition of success, and the realization that there are no longer foreign affairs but only world affairs, that it is now the world that matters and not merely those foreigners who do not belong. Even ministers of world affairs cannot solve the problems raised by those affairs unless and until they combine in a permanent system for carrying them on by constituting, either in the present League of Nations, a reformed League, or a different League, a world council for foreign affairs, which must have behind it, to be effective, a powerful élite of world citizens endowed with the necessary world patriotism to give these world statesmen their inspiration and guidance.

That is essentially the argument of Senor de Madariaga in both his books, whether as in "The World's Design" he is outlining his vision of a world commonwealth or, in "Theory and Practice in International Relations"*, discussing its practicability. Nor is his outlook unhopeful. The mere existence of a machinery of world government in the League is a symbol of unity around which much may coalesce. Senor de Madariaga points also to other factors accelerating progress—the success already achieved in international co-operation in those fields such as health and communications, where the professional interest in getting the problem solved is dominant: the slow creation of a community spirit: the moral pride which makes nations compete for the place of the most virtuous at least in international assemblies.

However threatening the situation may be, it is at least not one for despair, and it throws down a challenge not least to scientific workers. They must make their contribution to the evolution of a philosophy of world affairs in which the elements of competition, co-ordination and organization are brought into a more intelligent and co-ordinated synthesis, which preserves man's moral and intellectual freedom while ministering to his material needs. They have their professional contribution to make in special fields involved in the positive planning visualized by Senor de Madariaga, such as the establishment of a world administration for mandated territories, a world bank and a world trade commission. On them rests the responsibility for much of that research in social problems upon which such co-ordination must be based, and they can at least play a part in the education of their fellows to a vision of world affairs, the consideration of problems from the point of view of an organized and conscious mankind. The ethical declaration for the times recently issued (see

* Theory and Practice in International Relations. By Salvador de Madariaga. (The William J. Cooper Foundation Lectures 1937, Swarthmore College.) Pp. v+105. (London: Oxford University Press, 1937.) 6s. net.

NATURE, May 7) appears at a timely moment, and claims the allegiance and active support of all scientific workers. All that is noblest in the tradition of science urges them to make their contribution to the primary spiritual problem of creating a historical consciousness of mankind as organized dwellers of the earth and the methodical expression of it in a world State. For only as the method and energy of intelligent mankind bring order into the present chaos of man's activities can their great heritage of truth, justice, toleration and liberty be preserved for mankind.

Science in the Service of Man

Science for the Citizen: a Self-Educator based on the Social Background of Scientific Discovery. By Lancelot Hogben. (Primers for the Age of Plenty.) Pp. 1120. (London: G. Allen and Unwin, Ltd., 1938.) 12*s.* 6*d.* net.

THIS is no ordinary book. Like its predecessor, "Mathematics for the Million", it is a portent of a new understanding and a new purpose in science. We have had in plenty popular expositions of scientific discoveries; we have had attempts at the analysis of the history of science; we have had essays on its social implications; here we have all three together. They gain immensely from being presented as a unity and worked out by a single mind. In this new primer of one thousand pages, Prof. Hogben sets out to teach, to chronicle and to preach the gospel of science.

In his first main purpose, Prof. Hogben succeeds admirably. The presentation of science to the layman has rarely been at the same time so attractive and so comprehensive. Here the unity of conception of the work, the idea of science in the service of humanity, has led to an admirable balance between different branches of science, and has even succeeded in presenting science without the division into set subjects that has been the curse of its teaching throughout the last century and a half. The simplicity and directness of the explanations, and Horrabin's numerous and attractive figures, should ensure for it an even greater popularity and usefulness than had "Mathematics for the Million". The very fact that science is not presented as an explanation of the wonders of the universe but as a means to practical handling of everyday necessities should give it a wide appeal to young and active minds. In one respect, however, there is a relapse towards the older tradition of teaching. The chapters are followed by examples for working out, which are bookwork and calculations and not experiments. The audience for which Prof. Hogben is writing will surely want to do things and not only to work them out on paper.

Quite apart from its other values, "Science for the Citizen" would have to be read for the account it presents of the history of science. Here Prof. Hogben is following the modern tradition of relating the developments of science to social needs. In doing so he has given a new life and a new meaning to the records of the past and made sense of what was before merely a catalogue of mental achievements. For example, the great biological developments of the nineteenth century, the idea of evolution and the discovery of the mechanism of heredity seem no longer isolated advances but part of a renewed interest in the biological and mineral resources of the world, which were opened up by the new means of the industrial revolution, and of the need to improve stocks of animals and plants for the benefit of rapidly growing populations. Necessarily the account is abbreviated and selective, but it contains much new material and will set all scientific workers thinking of how much more needs to be done to make the history of their own fields something alive and able to point the way to future discoveries.

Prof. Hogben distinguishes clearly between three factors in the advance of science: the opportunity, the means and the motive. The opportunity lies in the social circumstances of the time, which are propitious or not to the advance of science; the means are those practical and material techniques drawn from industry or from other parts of science, without which research is impossible; the motives determine the setting of the problem and the concentration of the scientist's attention on it.

"Whether we choose to call it pure or applied, the story of science is not something apart from the common life of mankind. What we call pure science only thrives when the contemporary social structure is capable of making full use of its teaching, furnishing it with new problems for solution and equipping it with new instruments for solving them. Without printing there would have been little demand for spectacles; without spectacles neither telescope nor microscope; without these the finite velocity of light, the annual parallax of the stars, and the micro-organisms of fermentation processes and disease would never have been known to science. Without the pendulum clock

and the projectile there would have been no dynamics nor theory of sound. Without the dynamics of the pendulum and projectile, no Principia. Without deep-shaft mining in the sixteenth century, when abundant slave labour was no longer to hand, there would have been no social urge to study air pressure, ventilation and explosion. Balloons would not have been invented, chemistry would have barely surpassed the level reached in the third millennium B.C., and the conditions for discovering the electric current would have been lacking" (page 17).

It is, however, in the moral he draws from the study of present and past science that Prof. Hogben is at his best. In his own vigorous and inimitable style, he attacks what seem to him to be the enemies of both science and humanity, and points the way to effective social utilization of the results of science. To him, now as in the past, one of the chief enemies of science has been the use of deductive logic from self-evident principles. This legacy of Aristotle, which the physical sciences have managed to shake off, still hampers and distorts the social sciences and particularly the vital social science of economics.

"The past history of human culture shows that a high level of scientific attainment in isolated fields has flourished when men have been forced to bring their beliefs to the bar of fact and use them as recipes of social conduct. That the social sciences have not passed out of the stage from which the natural sciences were emerging in the time of Kepler is sufficiently evident from the following exposition of 'The Nature and Significance of Economic Science' by Prof. Robbins, which ends: 'In the last analysis, therefore, our proposition rests upon deductions which are implicit in our initial definition of the subject matter of Economic Science as a whole.'

"This passage briefly summarises every attitude to knowledge discarded by the natural sciences in reaching the prestige they now enjoy. The natural sciences owe their prestige to the fact that they provide man with the means of regulating his social conduct. They are able to do this because science rests on a wholesome distrust of logic, except in so far as the results of a logical process are tested continually by return to the real world" (pages 217–218).

The other enemy is introspective mysticism, the denial of the possibility of dealing in practice with the forces of Nature and society.

"The story of man's conquest of Substance and of Power will make it clear that we have reached a situation in which social machinery can no longer accommodate rapid advance in discovering the material amenities which science confers. We are thus faced with two alternatives. One is to devise the social machinery which will ensure the further progress of science by finding social uses for new discoveries. The other is to discredit confidence in the fact-loving method of science. This can be done most effectively by surrounding the work of the scientific investigator with an air of mystery, so that he fulfils the role of the first men of science in human history. The ancient calendar priests were the first scientists and the first civil servants. They ceased to be scientists as they aspired to become masters. The world tires of its masters and finds a growing need for efficient civil servants. So we may hope that the adventure of human knowledge will survive all the efforts to reinstate mysticism in the present period of cultural decay" (page 349).

Behind these two evils he sees the self-interest and greed of ruling minorities, who rather than lose their position will hold back the benefits which science could give to humanity.

"Science for the Citizen" avoids conventional divisions; it follows an order which is neither strictly that of subject nor that of time. It tends to deal first with the simpler mathematical and mechanical sciences and then leads through chemistry to biology. At the same time it tells the story of man's increasing understanding and control over Nature from the beginning of calendar lore at the dawn of history through the conquest of power and matter in the last century, to the beginning of the understanding of our bodies and our society in our own days.

The book is divided into five parts. The first: the conquest of time reckoning and space measurement, covers astronomy, mechanics and optics. For the first time, positional astronomy is presented with the full richness of its social background, and we understand why this apparently remote subject was of such practical and vital interest. One may wonder, however, whether Prof. Hogben's attempt to bring back "the use of globes" into teaching will be successful. These things were important, but for the ordinary city dweller of to-day the stars might just as well not exist.

The second section: the conquest of substitutes, tells the history of chemistry. It does full justice to the great revolution of the eighteenth century, which arising from the needs of the technical problems of the miner and cloth worker, laid the basis of our knowledge of chemistry. It traces the laying of the mysterious 'spirits,' through the operations of which men could escape from thinking concretely about material processes. It is, nevertheless, the least satisfactory part of the book, and the chapter on organic chemistry might well be rewritten in future editions, because though a competent account, it appears in its setting definitely dull.

The section on the conquest of power tells the story of the steam engine and electricity, and does it very well. The ideas of work and energy are fundamentally industrial and economic ideas; to understand them we need to call up again, as Prof. Hogben has done, the atmosphere of enterprising capitalism of the industrial revolution. It is, however, in the next section, the conquest of hunger and disease, that Prof. Hogben really comes into his own. Its two hundred pages are a triumph in the presentation of the whole of biology. Physiology, heredity and evolution fall naturally into their places, and the balance of the different aspects of the subject is well preserved.

In the last section, the conquest of behaviour, Prof. Hogben discusses psychology and the problem of nature and nurture, and draws his social conclusions in a final chapter which would stand by itself as an exposition of the modern outlook of the scientific worker.

Scarcely any scientific worker will agree with everything that is in this book; many will disagree violently with a great deal of it. It offers an easy target to detailed criticism, but most of this criticism will be beside the point. When a man is trying to do something that has been done before we may justifiably say it is well or badly done, but when he is doing something that has never been done before, the important thing is the actual creation, not the defects in it: afterwards, other people may avoid the mistakes and manage things better, the essential thing is to make the first attempt. The very novelty of the task that Prof. Hogben has attempted imposes its own limitations. It would be impossible for him to be equally successful over the whole field; certain parts are definitely weak, in others personal prejudices and predilections would seem to distort judgment. It is a pity that in spite of the several hands through which the manuscript has been, a large number of errors should remain in the text and in the illustrations. Most of them, it is true, are trivial, but one or two of them show that Prof. Hogben has not quite succeeded in the superhuman task of making all science his province.

The historical interpretation is the most difficult to appraise justly because here no one is in possession of enough of the facts, and the inevitable selection gives a definite bias to the work. It would seem to the reviewer, for example, that the importance of chemistry has been consistently underrated. Another more general criticism is the absence, except in the case of genetics, of any account of modern science and particularly of the revolution in physical science of the present century, which in the light of history will probably seem more important than those of the seventeenth and nineteenth centuries. It is true that this revolution has not made its effect felt in practice, but the absence of any mention of it gives the whole book an unexpectedly old-fashioned appearance. On the social side it would seem questionable to the reviewer that it is possible to achieve a rationally run society by the abandonment of localization of industry and by the social control of new industries alone. We are a long way yet from the time when every portion of the earth's surface might have equal natural potentialities or when heavy industries, coal, iron and power, will have ceased to be the keystone of the productive system.

It is made apparent throughout the book that it is the present system that is holding us back. On the kind of system that is needed to replace it Prof. Hogben is equally clear, but on how to get it he has very little to say, perhaps advisedly. The problem has been set; it is for the citizens rather than the men of science to solve it.

"Science for the Citizen" is full of new and suggestive ideas. No scientific worker after reading it can avoid looking at his work in a different way. It does not treat of deep philosophical questions, but instead gives us clear and practical directions, much more congenial to the English mind. These few sentences express plainly what chapters of learned works will find difficult to conceal:

"Science is not a photographic picture of the real world which exists independently of our views about it, and will continue to exist when we are no longer part of it. It is an ordnance map which guides us in finding our way in it" (page 329).

"The truths of science are recipes for human action, and science flourishes when it is actively ministering to social needs. It advances conspicuously in periods when men and women are actively engaged in rational endeavour to change their social environment, and is held back when those who participate in it are too anxious to find rationalisations for privilege or political strategy" (page 1057).

These ideas have been too much neglected in the past; it is for us to understand them and make use of them in planning science in the future, a science that can no longer proceed consciously indifferent to its potentialities for human welfare and the need to realize that potentiality.

"During the past century scientific knowledge has created new potentials of social organisation vastly in excess of anything for which the political education of mankind is prepared. Seventy years ago it was still possible to discuss whether poverty was morally tolerable or materially inevitable. It was still possible to discuss whether war was spiritually edifying or socially escapable. All this

is changed. Poverty in the sense in which it was then defined, the sense in which the word is intelligible to the social biologist, is not materially inevitable. War is not a moral picnic. It threatens to destroy the entire fabric of our civilisation, if we do not eradicate it with as much promptitude and ruthlessness as we have eradicated, or are eradicating, smallpox, malaria, and yellow fever" (page 1081).

Science is a part, and an essential part, of the great struggle in which we are all willy-nilly now engaged. It has something definite to offer, something which, in his conclusion, Prof. Hogben calls the New Social Contract.

"Advancing scientific knowledge has swept away many beliefs which sustained popular aspirations in the formative stages of modern democracy. . . . In their place modern science offers us a NEW SOCIAL CONTRACT. The social contract of scientific humanism is the recognition that the sufficient basis for rational co-operation between citizens is scientific investigation of the common needs of mankind, a scientific inventory of resources available for satisfying them, and a realistic survey of how modern social institutions contribute to or militate against human needs" (page 1089).

We may or may not like this book, but we cannot deny that it raises issues which we all have to face. J. D. B.

Plant Viruses and their Hosts

A Textbook of Plant Virus Diseases

By Dr. Kenneth M. Smith. Pp. x + 615. (London: J. and A. Churchill, Ltd., 1937.) 21*s*.

DR. KENNETH SMITH, having written an earlier volume upon the physiology and general behaviour of plant viruses, has recently completed another book with a pronounced taxonomic flavour. It is here possible to obtain, for the first time, a detailed conspectus of the whole number of plant viruses known at present.

One gratifying feature is that plant viruses are arranged upon a plan of classification which has already reached a considerable degree of success in the hands of Prof. James Johnson of Wisconsin University. Dr. Smith uses a slight modification of the Johnson classification, and employs the scientific generic name of the host, followed by a number, to denote a particular plant virus. Thus 'Nicotiana Virus 1' is the disease formerly known as tobacco mosaic. A list of synonyms is given for each disease, and the text is somewhat of the calibre of a critical fungus flora, in so far as it crystallizes one definite name from a number of varying designations. It is delightful to be guided among the formerly bewildering potato viruses by so sure a hand, and the relations of virus maladies upon tobacco and tomato also become clearer. Properties of each virus are given in relation to external physical and biological agents, to various methods of transmission, and to particle size. The diseases caused by the particular virus are described for the various host plants, and Hutchinson's classification is used both for this and in the general arrangement of the volume.

An appendix, which gives the most characteristic symptoms of virus diseases, is arranged alphabetically by the names of the hosts, and should be particularly valuable for general diagnosis. A chapter upon the insect vectors of plant viruses describes the various species, with all the resources of Dr. Smith's specialist work, and includes notes upon life-histories and geographical distribution. More than a hundred plates embellish the volume, and the author has enlisted the co-operation of numerous research workers in many parts of the world, to provide adequate pictorial representation of the subject. The extensive references to published work are further evidence for the completeness of knowledge collected in the present volume.

A text-book is usually an exposition of a science already organized; a portrayal of clarified thought which has withstood the test of continual teaching. Dr. Kenneth Smith's book actually does the organizing and performs the clarifying. It does more; for it provides a framework into which future results may be fitted. The scheme of classification is already sufficiently accepted by research workers in plant viruses, and is backed in the present volume by a wealth of description. It would seem inadvisable for any research worker to depart from it until the time shall have arrived when it will be possible to give each virus a more satisfactory binomial nomenclature. There is also, at the present time, sufficient information upon virus diseases of plants collected into volumes which are readily available, so that the subject might well enjoy a new popularity with the profession of teaching. Viruses are economically of greater importance, as causal agents of plant diseases, than are bacteria, and the volume under review removes the last excuse for a somewhat neglected exposition to students. J. G.

Biography of Madame Curie

Madame Curie

By Eve Curie. Translated by Vincent Sheean. Pp. xii + 411 + 31 plates. (London: William Heinemann, Ltd., 1938.) 18*s*. net.

INTERESTED as we are in the sources of scientific creation, we must welcome the appearance of a book which is a touching example of filial piety and at the same time an excellent biography of one of the most eminent scientific workers of our epoch. It has considerable artistic and documentary value. I think it gives a fairly complete answer to the question how it could happen that a young girl from a foreign country was called to acquire a fame which made her name a symbol, and to become a leading scientific personality not only in her native and adopted country, but also throughout the world. In fact the book tells us of national, social and hereditary factors which contributed to the formation and development of the exceptional gifts of Mme. Curie's mind and character.

Very few of those who admire this great woman realize that in the second half of the past century women played a great part in Poland. Strange to say, this fact was due to the loss of independence and severe conditions imposed by the Russian domination. Political thought and national feeling were for the most part compressed into family life, with the result that women were often equal to men in assuming full civic responsibility. Another consequence was a great movement towards 'emancipation' and university education for women. Young girls often went abroad to study at a university. This tendency would certainly not be opposed in the highly cultivated Skłodowski's family where all told young Manya of the value of intellectual effort. The moral atmosphere was that of strenuous work, of sense of duty, of patriotism. Strength of will was her inborn quality—the photographs show it clearly on her "stubborn face"—but the experiences of her childhood and youth, the early necessity of earning her living as a governess, hammered this good material and made her a rare example of endurance and tenacity. The following fact illustrates the spirit of self-sacrifice which reigned in this family. When Bronya, the older sister, went to Paris to study medicine, the younger one helped her with money saved from her meagre salary and patiently awaited her own turn. When it came at last, she studied with passion, living confined in the "icy garret", ignoring world and pleasure. What moved her was the desire to be useful to her family, the faith in her abilities and something specifically Polish: ambition fed by the love for her country.

There is scarcely any other scientist's life which shows in such a striking way how great achievements in science are due to the association of moral and intellectual qualities. Of course it was remarkable scientific insight to conceive the idea of radioactivity as an atomic property, but the actual discovery of radium—and what was perhaps more difficult, its purification from two tons of ore—conducted in the famous shed in the worst conditions one can imagine, were only possible owing to the incredible tenacity of this delicate woman; and we still see this strength of will throughout Mme. Curie's later life. Her resolution to face the gravest responsibilities immediately after Pierre Curie's death, that terrible tragedy which might have broken even a strong man's nature, attained to heroism. No less heroic were her activities during the Great War, when moved perhaps by some ancestral influences, she organized, careless of danger, the then neglected X-ray examination of wounded soldiers both behind and practically in the lines of the French armies. Who could fail to admire her continual struggle against illness, the firm decision to work up to the last moment? One might say that she was taken almost directly from the laboratory to her death-bed.

All these facts belong perhaps more to the *vie romancée* than to a scientist's biography. But in Mme. Curie's life romance was mixed with science. When we read Mlle. Eve Curie's book, the beautiful account of the great days spent by the Curies at work, of their holidays, of misery and glory, we do not know what comes first: a story of love or of one of the greatest scientific discoveries of our times. Of the later scientific activity of Mme. Curie, the book tells us not as much as we might desire. This is not a reproach: Mlle. Curie is an extremely intelligent person and a brilliant writer, but she is not directly interested in science. A scientist is, after all, a human being and we want to know how race, milieu, physical and spiritual constitution show themselves in his life and activity.

I have watched Mme. Curie's work for years, but never understood it as well as after reading Eve Curie's book. May I express to her my personal thanks, which will also be shared, as I hope, by scientific workers throughout the world.

L. WERTENSTEIN.

Die Tierwelt Deutschlands und der angrenzenden Meeresteile nach ihren Merkmalen und nach ihrer Lebensweise

Begründet von Prof. Dr. Friedrich Dahl. Teil 31 und 32: Spinnentiere oder Arachnoidea. vii: Wassermilben oder Hydracarina (Hydrachnellæ und Halacaridæ). (1) Pp. x+288. 24 gold marks. (2) Pp. 289–574. 24 gold marks. Teil 33: Spinnentiere oder Arachnoidea. viii: Gnaphosidæ, Anyphænidæ, Clubionidæ, Hahniidæ, Argyronetidæ, Theridiidæ. Pp. ii+222. 20 gold marks. (Jena: Gustav Fischer, 1937.)

THE issue under notice of this well-known work deals with six families of spiders and is more substantial than any of its predecessors in this order. It includes descriptions of 169 German species, in 39 genera, with notes on their distribution, both in Germany and elsewhere, and full dichotomic tables for their separation. The classification used is that of Petrunkevitch, 1933; for example, the water-spider, *Argyroneta*, occupies a family by itself. The illustrations are a striking feature of the work. There are more than 500 clear line diagrams of genitalia and other pertinent parts, which are invaluable for purposes of identification, and many of which have never been published before. The value of the work to British readers is very great. About ninety of the species described occur in Britain, all being mentioned as so doing, and as a help in naming the species of some of our most important families, this work far surpasses anything previously obtainable.

This is not so forcibly true of the two parts on water-mites, for the Ray Society publications of 1925, 1927 and 1929 have covered the same ground. Dr. Viets' work opens with thirty valuable pages on the habits of water-mites, and he also gives directions for collecting, preserving and mounting them. In the systematic portion, 441 species of German water-mites are described in 92 genera and illustrated by more than 650 clear diagrams. There is a greater uniformity of treatment here than in the part on spiders, which is the work of three contributors, but all three parts should be assured of a welcome proportionate to their undoubted value. T. H. S.

Annual Reports on the Progress of Chemistry for 1937

Vol. 34. Issued by the Chemical Society. Pp. xvi+540. (London: The Chemical Society, 1938.) 13*s*.

IN these annual reports, no attempt is made to present a comprehensive review of the year's chemical publications; to do so would result either in a volume of size so great as to defeat its purpose or in surveys so lacking in detail as to be valueless. Instead, these reports perform the much more useful and attractive service of providing a collection of "proofs of evidence by expert witnesses" concerning selected fields where researches of fundamental importance are being actively prosecuted.

The first report is devoted to radioactivity and sub-atomic phenomena. The second deals with non-radioactive isotopes, chemical kinetics, photochemistry, intermolecular forces and the properties of liquids, and electrochemistry. Inorganic chemistry is represented by chapters on sodium metaphosphates and polyphosphates, the rare earths, compounds of boron, halogen oxides, and the behaviour of elements and compounds at high pressures. Crystallography is represented by sections on lattice defects in polar crystals, crystal chemistry, the structure of liquids and amorphous solids, and molecular crystals. A report on the structure and stereochemistry of simple organic molecules is followed by others on general methods, free radicals, carbohydrates, proteins, triterpenes, heterocyclic compounds, porphyrins, and rubrenes and azulenes. There are substantial sections on animal and plant biochemistry, whilst analytical chemistry is dealt with not only from the general inorganic point of view but also in the special aspects of spectrum and of rock analysis. A. A. E.

John Locke

By Prof. R. I. Aaron. (Leaders of Philosophy Series.) Pp. x+328. (London: Oxford University Press, 1937.) 12*s*. 6*d*. net.

THIS excellent book on a thinker who is a classic in philosophy will give fresh impetus to discussion and controversy. It is not the first part of this work, which deals adequately with Locke's life, or the third part, where we find a good summary of Locke's views on moral philosophy, political theory, education and religion, which may be a ground of dissent; but rather the second part, which deals with the central points of Locke's psychology and systemology. The author's interpretation of the term 'idea', for one thing, scarcely helps to set one's mind at ease about Locke's meaning of this term. There is also the disturbing view that "we now find Locke asserting that sensation is itself knowledge for we know in it the existence of things" (p. 244), which is not supported by any quotations from the "Essay". The author's main purpose is to interpret Locke as a representationalist in his theory of ideas, a view which seems rather to restrict the aim and value of the "Essay". The brief reference made to Locke's views on the positive sciences are coloured by this interpretation. If this is allowed for, Prof. Aaron's book may be regarded as a notable addition to philosophical scholarship. T. G.

Sur les autres mondes

Par Lucien Rudaux. Pp. vi+222+20 plates. (Paris: Libr. Larousse, 1937.)

THIS work is a comprehensive and detailed account of the sun, moon and planets, intended for the general reader. The author adopts the historical method and leads the reader gradually to an up-to-date picture of each of the bodies concerned, with a carefully planned exposition of planetary phenomena. M. Rudaux is also a most accomplished artist and the book is profusely illustrated with diagrams and coloured plates, the latter being mainly imaginative reconstructions of the planetary and lunar scenes. As an example of his pictorial method, we may mention the aspect of Saturn and its rings as seen from one of Saturn's satellites. The author and publishers are to be congratulated on a really magnificent production. W. M. S.

Sewage Discharge and the Mersey Estuary*

Co-operation in Technical Research

THIS handsome and well-illustrated report on the Mersey estuary, which has been issued by the Department of Scientific and Industrial Research, is an example of the working of the best English tradition of co-operation in public affairs. It exhibits the Department in a part for which it is so well equipped—which it might be more often called upon to play—that of an arbiter to determine the scientific facts for the solution of a controversial problem of great public and economic importance. It shows the various public authorities of Merseyside agreeing, in spite of a conflict of interests, to co-operate in order to obtain an independent scientific inquiry; it also shows them evincing their confidence in the Department of Scientific and Industrial Research by inviting it to undertake the investigation. The Department asked the Water Pollution Research Board to be responsible for the scheme of the investigation; so, in a typically national way, another party to the co-operative work was a body of scientific men who gave honorary service.

The problem was the effect upon the estuary of the Mersey of the discharge into it of crude sewage from the large populations of Liverpool, Birkenhead and Wallasey, among others. The volume of the estuary is very great, and matters of health and amenity were not part of the inquiry. The problem was the narrower one of the effect of this discharge of sewage on the estuary as a channel of navigation. The opinion had been put forward that the presence of sewage increased the rate of sedimentation of solid matter in the water of the estuary, and by alteration of the character of the deposit increased also the difficulty of its removal by dredging. Such a possibility led naturally to some competition of interests between the corporations responsible for the sewage discharge on one hand and the authority responsible for the navigation and conservancy of the river on the other. The data for determining whether these possibilities were actualities were not available. Accordingly representatives of the various interests, after meeting in conference in 1932, decided, with admirable judgment, to ask the Department, as has already been stated, to investigate the matter and to give an authoritative pronouncement on the scientific facts. The local authorities and other authorities and companies concerned agreed to bear the costs of the inquiry, and agreed also that "on the issue of scientific fact the result of the investigation should be accepted as conclusive". The understanding come to was thus one which reflected great credit on all concerned, and was a signal mark of confidence in a Government Department. The agreed procedure, in the words of the preface, "might well be followed by others in dealing with controversial problems affecting many interests".

The investigation, which was begun in 1933 and lasted over a period of four years, consisted of a wide-reaching, hydrographical, chemical, and biological investigation of the effects of the discharge of crude sewage. The area to be studied embraced the navigable channels of Liverpool Bay, the tidal pool of the Upper Estuary—with a volume at high water of a spring tide of about 1,000 million cubic yards—and the Narrows which connect the two.

The Mersey Docks and Harbour Board has, since 1861, made quinquennial surveys of the capacity of the Upper Estuary, and its data show that during the period 1906–31 there was a decrease of about 52 million cubic yards. This reduction in capacity naturally led to the suggestion, already referred to, that the presence of sewage had been responsible, by bringing about a deposit of mud of such a consistency that it was not eroded by the tidal stream. In order to investigate this possibility, the records of hydrographical surveys of the Mersey made by the Mersey Docks and Harbour Board were examined, with other hydrographical data, to determine the positions and levels in the Estuary at which accretion and erosion had occurred during this period. The quantities and nature of the sewage and principal trade wastes discharged into the estuary were ascertained, the concentration of polluting substances in the estuary water under different tidal conditions was determined, and an estimate was made of the length of time spent by polluting substances in the estuary before passing out to sea. The concentration of mud and silt eroded by the tide from the bed and foreshore of the estuary and carried in suspension in the moving water was also determined.

Numerous laboratory experiments were then made to observe the effect of sewage on the rate of sedimentation of mud and silt under conditions similar to those which occur in the estuary. The factors studied included the concentration and

* Estuary of the River Mersey. The Effect of the Discharge of Crude Sewage into the Estuary of the River Mersey on the Amount and Hardness of the Deposit in the Estuary. (Department of Scientific and Industrial Research. Water Pollution Research: Technical Paper No. 7.) Pp. xvii+337+8 plates. (London: H.M. Stationery Office, 1938.) 30s. net.

state of division of the solids, the depth of water through which sedimentation occurred, the temperature and salinity of the water, and the effect of the addition of different proportions of sewage and of suspensions of bacteria derived from sewage. In some series of experiments before the rate of sedimentation of the solids was measured, samples of saline water containing mud and sewage in suspension, were stirred at different speeds, thus reproducing the conditions in the estuary, where water containing silt, mud and sewage-solids in suspension is carried to and fro by the tide.

Numerous samples of mud and other solid matter for examination were collected from different parts of the Upper Estuary of the Mersey and from Liverpool Bay. For comparison, samples were also collected from relatively unpolluted estuaries and marshes in Norfolk, Suffolk, Essex, Devon, Monmouth, Cheshire and Lancashire, from the Firth of Tay in Scotland, Lough Foyle in the north of Ireland, from estuaries in Eire, and from the bed of the Irish Sea. The concentration of organic matter and the principal inorganic constituents were determined by analysis, and the relative resistance of the different muds to erosion by a moving stream of water was observed.

One of the most interesting results of the investigation was the conclusion that the most likely source of new mud entering the Mersey Estuary is the bed of Liverpool Bay and of the Irish Sea. As to the quantity of suspended inorganic matter contributed by the sewage, one can calculate from the volume of daily discharge (30–40 million gallons or 180,000–240,000 cubic yards) that the quantity of *inorganic* matter discharged *in a year* is less than 25,000 cubic yards, that is, less than 0·0025 per cent of the capacity of the Upper Estuary. It is also to be noted that the concentration of sewage in the estuary water is not high; in the greater part it does not exceed 1 per cent by volume, and in no considerable volume of water does it exceed 5 per cent.

Another striking result obtained was that the concentration of organic matter in mud from the Mersey, usually less than 3 per cent, was *no higher* than that of samples of mud from the bed of the Irish Sea, from Liverpool Bay, and from *relatively unpolluted* estuaries, a number of which were examined. The composition of the mud, therefore, provides no evidence that sewage is responsible for its deposition.

The question of the precipitation or deposition of mud in the estuary was naturally of great interest, and one to which much attention was paid in the investigation. It was of course possible, as had been suggested, that there was some physical action between the suspended sewage and the suspended mud, leading to a co-precipitation of material. Elaborate experiments, first with salt water and later with the addition of sewage, were therefore undertaken on the rate of sedimentation of mud from the Stanlow Bank (which includes most of the mud in the Upper Estuary), of mud from Liverpool Bay, and also of muds from various relatively unpolluted estuaries. The result observed was that the rates of sedimentation in saline water of muds from the Stanlow Bank and from the bed of Liverpool Bay were similar, and they were on the whole rather lower than those of muds from a number of unpolluted estuaries. There was thus no evidence that in water without sewage the Mersey muds precipitated more rapidly.

The observations on the effect of sewage on the rate of sedimentation were of especial interest; they indicate the importance of carrying out such studies under a wide range of conditions if erroneous conclusions are to be avoided. With small depths of fall, the addition of 5 per cent of crude sewage gave a slight but definite increase in the rate of sedimentation. When, however, the sedimentation was followed in columns of 40 ft., the sewage had no effect, although it is to be noted the concentration employed was far higher than that occurring in the estuary. The explanation appears to lie in the state of aggregation of the mud. In settling through such considerable depths as 40 ft., the mud aggregates into large clots with so high a consequent rate of settling that the effect of the sewage becomes negligible. That these conditions apply in the Mersey was shown by the observation that mud carried during the run of the tide in the estuary is generally in the form of large aggregates; similar aggregates were found for the mud carried in suspension by the water of the comparatively unpolluted estuaries of the Rivers Suir and Barrow.

The question of the ease of erosion of Mersey muds was carefully investigated and from several aspects, though, as has already been stated, the most likely source of any large quantity of new mud which may enter the Upper Estuary is the bed of Liverpool Bay and the Irish Sea. There appeared to be little erosion of mud from the surface of the banks in the Upper Estuary, since these are mostly more than 20 ft. above Liverpool Bay Datum level and so are covered only near high water when the stream velocity is low. Considerable erosion often takes place, however, from vertical faces of a mud bank exposed to the full force of the tidal stream. By the use of a suitable laboratory method the 'erodibility' of mud from different sources was compared, with the result that with Mersey mud the resistance to erosion is *slightly less* than that of mud from estuaries in Suffolk and Essex which are comparatively unpolluted.

The data of dredging operations point in the same direction as studies of mud erosion. Dredging of the sea channels in Liverpool Bay has been carried on since 1880 and records of the operations are available. Those of two dredgers for the period 1909–35 were examined in detail, but the returns gave no evidence of any increase in the difficulty of dredging during those years.

With regard to the changes in capacity of the Upper Estuary, the report accepts the values put forward by the Mersey Docks and Harbour Board. The surveys by the Board show that between 1871 and 1886 the capacity rose by 48 million cubic yards, that is, by 5 per cent. Between 1886 and 1891 it declined by 5·5 per cent of the former value, but rose again in 1906; between that year and 1926 there was a loss of 5·2 per cent. The survey of 1936 shows an increase of capacity over 1931, the decrease on the 1906 value being only 4 per cent. The capacity was approximately the same in 1936 as in 1871, 1891 and 1916, so that the changes do not indicate any regular decrease in capacity with time, such as would be expected from a gradually increasing discharge of sewage.

Finally, results most illuminating for the points at issue were obtained by a consideration of the losses of capacity at different *horizontal* levels, and also of the distribution of mud and of sand. Half the loss of capacity was due to deposits below the level of Liverpool Bay Datum (L.B.D.), and only about 10 per cent to deposits above a level of 20 ft. above L.B.D. Mud, however, is found almost entirely on banks of a height greater than 20 ft. above L.B.D.; banks of lower height are comprised almost entirely of sand. It is thus plain that reduction of capacity does not coincide with the present distribution of *mud* banks.

From the report, it is thus evident that the answer to the question proposed needs no balancing of conflicting evidence. Converging lines of testimony have been drawn from (*a*) the amount of inorganic matter brought into the estuary from sewage, (*b*) the concentration of organic matter in the mud, (*c*) the effect of sewage upon the composition and rate of sedimentation of mud in the condition of suspension in which it is found in the water of the estuary, (*d*) the resistance to erosion of mud from the Mersey in comparison with that of muds from relatively unpolluted estuaries, (*e*) a comparison of the reduction of capacity in different parts of the estuary with the distribution of mud and sand. All these give an unequivocal negative to the question as to whether the discharge of crude sewage has had any effect on the amount and hardness of the deposit in the estuary.

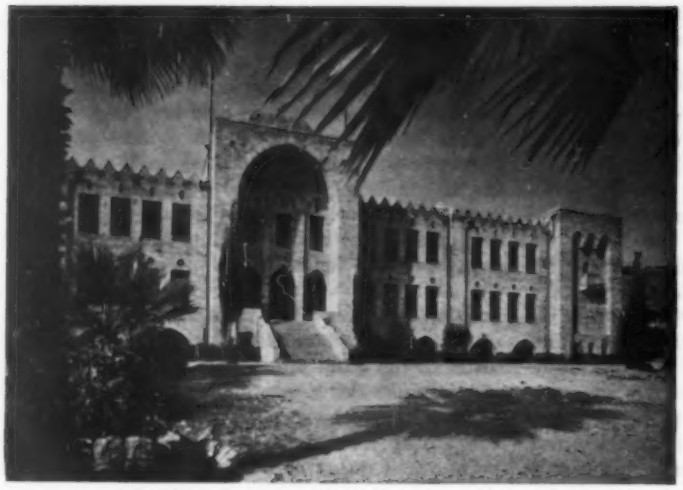
This study of the Mersey estuary should long stand as a classic one in the field of applied science, not only for the width and scope of the investigation but also for the decisiveness of its results and the civic importance of its findings. Its origin makes it a shining example to other public authorities who may similarly find themselves faced with controversial problems which can be solved by scientific analysis.

The Hebrew Technical Institute, Haifa*

THE Hebrew Technical Institute in Haifa is the centre of technical training and research for the young Jewish community in Palestine. Hebrew is the language of instruction, but the college is open to all, making no distinction of race or creed; and a few Palestine Arabs have availed themselves of this opportunity. The curriculum is extensive, and includes courses leading to university degrees in the technical college proper (500 students), a trade school for training skilled artisans and foremen (250 pupils), special vocational training classes for refugees, courses for agricultural workers, and evening classes. At present there are about a thousand students altogether; examinations are held under the supervision, and with the help of, the Palestine Government. The Institute was founded about thirty years ago; but, owing to the Great War, did not begin its academic work until 1924. Its progress offers an opportunity for the study of the effect of colonization on the development of an educational institution.

Colonization in Palestine does not mean the establishment of foreign trading stations on the coast-line, but the building up of a new national life in all its branches and with all its implications, in a limited area, and under the pressure of thousands of families from the countries of middle and eastern Europe forced to immigrate for economic, social or political reasons. The Jews left Palestine about two thousand years ago and can only return in larger numbers if, both in agriculture and in industry, they make the utmost use of the advances of pure and applied science. Owing to social prejudices and to legal restrictions imposed upon them by the people among whom they lived, the Jews were, for many centuries,

* A booklet "The Hebrew Technical Institute, Haifa; Its Achievements and its Aims (Haifa, 1938)" has just been published and will be sent, free of charge, on application to the Secretary of the Institute, P.O.B. 910, Haifa (Palestine), or to the Hon. Sec. of the Auxiliary Group of the H.T.I., (Mrs.) B. Buckman, 21 Willow Road, London, N.W.3.



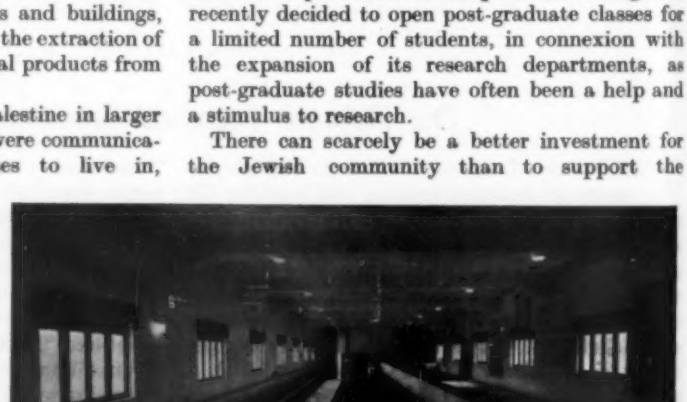
THE HEBREW TECHNICAL INSTITUTE, MAIN BUILDING

debarred from agriculture, trades and professions. In some eastern European countries, these laws were rescinded less than twenty years ago. They have to learn many things anew, and it is difficult to overestimate the importance of technical training in their return to the Holy Land. That they are capable and willing to learn, and that they have not lost their old vigour and enterprise is shown by such examples as the improved production of Jaffa oranges, the introduction of reinforced concrete in the construction of roads and buildings, the electrification of Palestine, and the extraction of potash, bromine and other chemical products from the Dead Sea.

When Jews first returned to Palestine in larger numbers, their first requirements were communication between settlements, houses to live in, reclamation of land, drainage of swamps, provision for water supplies, drainage of towns and villages, and the means of intensive agriculture. Therefore, the two departments first developed in the Technical College proper were those of civil engineering and architecture. With the further development of industry, a third, the Department of Industrial Engineering, was recently opened. This consists of two sections: one for electromechanical engineering, and one for chemical technology. The staff of this third department was largely recruited from German-Jewish men of science during the years 1933 and 1934. There are now nine working laboratories, which are used for teaching and research, and two more are being equipped. Besides the general science laboratories, mention should be made of the building materials testing laboratory, the hydraulics laboratory (erected with the help of the Palestine Government, and probably the finest in the Near East), the metallurgical laboratory and those for electrical and chemical technology. Some laboratories are still housed in temporary buildings, and some are not yet completely equipped. But a good beginning has been made, and this appears to guarantee the success of future developments.

The Institute has just launched a campaign for an extension fund. The increasing number of students who apply for admission necessitates the opening of new departments in order to offer a greater variety of courses. The development of industrial life calls for an extension of research work in almost all branches of exact and applied sciences. Raw materials must be tested, new processes devised, known processes revised, and methods of production developed. The College has recently decided to open post-graduate classes for a limited number of students, in connexion with the expansion of its research departments, as post-graduate studies have often been a help and a stimulus to research.

There can scarcely be a better investment for the Jewish community than to support the



EXPERIMENTAL HALL OF THE HYDRAULICS LABORATORY

extension fund of this Institute, which paves the way for the development of industry in Palestine in so many directions. The Institute prides itself on being almost self-supporting. Eighty per cent of its income is derived from tuition fees and fees paid by industry for the use of the laboratories. This is a very good record for an educational institution, and a closer analysis of its income immediately shows the reason for it. Last year's budget amounted to about £20,500. If one deducts from this a non-recurrent grant from the Palestine Government (ear-marked for new buildings and equipment), the income only amounts to £17,200. This is very small for an institution in which one thousand pupils are trained: it is obviously a starvation figure and must imply either curtailing teaching or research activities or both. The outside observer concludes, with a feeling of uneasiness, that the Jews in Palestine are about to repeat the mistakes of European countries against which men of science and engineers have been fighting in recent years. It is a grave mistake to distribute the income of a community in such a way that it is impossible for scientific institutions to develop all their resources. From the point of view of the present as well as of future generations, scientific work gives by far the highest return for money spent. Considering the particular circumstances of colonization in Palestine, and the small number of scientific institutions concerned, there is no reason why they should repeat errors which are only now being overcome in Europe and America.

There is one other point worth mentioning here. The library of the Hebrew Technical Institute is the only technical library in Palestine, and is much frequented by engineers, men of science, teachers and Government officials from all over the country. Unfortunately, the English section seems to be rather small, and a large number of scientific and technical books and journals published in England are lacking. This is not to be wondered at, as anyone will know who has tried to set up a new scientific library with little money. Jews go to Palestine mainly from the Continent, but are prepared to take up English as their second language to Hebrew and to come into more intimate contact with British thought. The library of the Hebrew Technical Institute at Haifa is therefore commended to the generosity of publishers and learned societies in Great Britain.

Cosmic Rays

A DISCUSSION meeting of the Royal Society was held on May 26 on "Cosmic Rays". The discussion was opened by Prof. P. M. S. Blackett, and papers were read by Profs. P. Auger (Paris), E. Regener (Stuttgart), and J. Clay (Amsterdam). After some further specific contributions from workers in Great Britain, a general discussion followed.

It is now generally agreed that cosmic radiation, as observed at the earth's surface, consists of two components distinguished empirically by their different rates of absorption. The 'soft' component, which constitutes about 20 per cent of the total cosmic ray intensity at sea-level and is practically all absorbed at a depth of 10 m. of water below sea-level, is now believed to consist of high-energy electrons which obey Dirac's relativistic theory. The application of this theory to the emission of radiation by such electrons in nuclear collisions, and to the production of electron pairs by radiation, has in fact provided in a remarkably unforced manner a satisfactory explanation of the absorption of the soft component and the phenomenon of electron-showers which accompanies its passage through matter.

The hard or penetrating component, on which most of the discussion was centred, is of considerable interest in that it is now supposed to consist of particles of a 'new' type, possessing electronic charge but a mass greater than that of an electron and less than that of a proton, provisionally referred to as 'heavy' electrons.* This interpretation of the hard component was suggested about a year ago by Neddermeyer and Anderson on rather circumstantial grounds, but more direct evidence has since been obtained for the existence of such a particle in cosmic rays. This evidence comes from the observation, in a Wilson cloud-chamber, of tracks the ionization and curvature (in a magnetic field) of which are not consistent with electrons or protons, but indicate a particle with electronic charge and a mass about 200 times that of an electron (that is, about one tenth protonic mass).

Examples of such tracks obtained by different workers were shown during the meeting. The comparative rarity of these anomalous tracks may be attributed to the small distance the particles travel after their velocity has fallen sufficiently low to give

* That the hard and soft components consist of different kinds of particles, rather than particles all of the same kind but of different energies, was clearly put forward by Auger in 1935 (NATURE, **135**, 820; 1935). Auger's description of the soft component is almost identical with our present view, and for the hard component he suggested "heavy particles such as protons".

tracks with an ionization clearly distinguishable from that along tracks of the same curvature produced by electrons or protons.

In his opening address, Prof. Blackett set forth the 'birth, life and death' of the heavy electron as the main problems now awaiting solution. Prof. P. Auger described recent experiments which contribute to an understanding of the manner of their creation. In these experiments the frequency of coincident discharges of a number of counters of high resolving power (*c.* 10^{-4} sec.) is observed. The results obtained indicate the existence (in the open) of showers spread over at least 25 sq. m. and containing at least 1,000 particles. The observation of crucial interest, however, is that the particles in these showers have a range of about 15 cm. of lead. This means that the particles are of the penetrating type, that is, heavy electrons. It seems, therefore, that a whole shower of heavy electrons may be created in one act, and the experiments are consistent with the view that the heavy electrons are secondary in origin.

The heavy electrons are penetrating because, owing to their large mass, very little radiation is emitted in nuclear collisions, this emission of radiation being the process which stops high-energy electrons and gives rise to the ordinary 'cascade' showers. However, though the energy lost by the penetrating particles in traversing matter is very much less than that lost by electrons, it is yet appreciably greater than the theoretical energy loss by particles of 200 electron masses. The latter is mainly due to collisions with atomic electrons, with a small contribution from collisions with atomic nuclei. Prof. P. Auger reported measurements carried out in collaboration with P. Ehrenfrest according to which the actual loss is more than three times the theoretical value. The experiments of Blackett and Wilson require a still higher ratio. This discrepancy is of much interest and its further investigation may throw light on the properties of the new particle.

The ultimate fate of the heavy electrons is not yet clear. Comparatively few are observed with energies less than about 2×10^9 volts, suggesting their disappearance or transformation into electrons at this energy (Blackett). However, in this region the velocity of the heavy electron starts to fall appreciably below that of light, and the attendant rapid increase in ionization would in any case reduce the relative number of heavy electrons with energy much below 2×10^9 volts. No definite conclusion regarding this matter can be drawn from existing observations.

The heavy electron is not unwelcome to theoretical physicists. Such a particle was in fact envisaged by Yukawa so long ago as 1935 in order to explain the force between a proton and a neutron. Previous attempts to explain this force on the basis of electron exchange and Fermi's theory of β-decay gave results of a wrong order of magnitude. Yukawa assumed that the role of exchange was taken by a new type of particle and showed that to explain the observed force the new particle would have to be given a mass of about 200 electron masses—in remarkable agreement with the particle now found in cosmic radiation. Thus, in much the same way as the positive electron in cosmic rays bore out the predictions of Dirac's theory of negative energy states, the heavy electron bears out the crucial assumption in Yukawa's theory of nuclear forces. This theoretical aspect of the subject was dealt with by Dr. W. Heitler and Dr. H. J. Bhabha. Dr. Heitler showed how the original theory of Yukawa had to be modified to give the right dependence of the forces between a neutron and a proton on the orientation of their spins, and also showed that the mass attributed to the new particle to explain the forces also corresponds to the departures of the magnetic moments of a neutron and proton from the values required by Dirac's theory for elementary particles. Dr. Bhabha discussed the applications of the theory in the creation and behaviour of the heavy electrons in cosmic rays. In reply to a question, Sir Arthur Eddington stated that while the 'background' particle of his recent theory might be made to play the part in nuclear forces similar to that assumed in Yukawa's theory, he would not expect it to be able to exist in the free state as, for example, a cosmic ray particle.

Matters concerning the effect of the earth's magnetic field were discussed by Prof. J. Clay and Dr. E. G. Dymond. Prof. Clay finds that the line of minimum cosmic ray intensity, though always close to the magnetic equator, shows definite departures from it, and the significance of this was discussed. Another effect reported by Prof. Clay was a decrease in the intensity of the soft component of cosmic rays during a magnetic storm, indicating a disturbing current of about 10^7 amperes at two to four earth radii away. Dr. Dymond gave an account of his experiments made in collaboration with Dr. Carmichael on the variation of cosmic ray intensity with altitude in the region of the north magnetic pole (see also NATURE, **141**, 910; 1938). The agreement of the results with those of Regener in lower latitudes (49°) indicates a lower limit of about 3×10^9 volts to the energy of the cosmic ray particles in this region of the solar system. The suggestion that this cut-off is due to the sun's magnetic field is unacceptable if recent estimates of its magnetic moment are reliable. The cut-off would accordingly refer to the cosmic rays in outer space, and its cause is not yet understood.

Prof. Regener described experiments on the variation with time of the hard component. Periodic variations both with respect to solar and sidereal time are found. The former has an amplitude of 0·25 per cent, with maxima at 10^h and 22^h. The variation with sidereal time has a smaller amplitude with a maximum at about 18^h, and may be attributed to the effect of galactic motion suggested in this connexion by Compton.

While there is obviously much to be cleared up in the field of cosmic rays, the discussion left the impression that the subject is not as much in a state of confusion as it has often been in the past.

E. J. WILLIAMS.

Obituary Notices

Prof. W. Stroud

PROF. WILLIAM STROUD, chairman of the firm of Barr and Stroud, Ltd., died at the age of seventy-nine years on May 27, at Torquay.

At an unusually early age young William Stroud of Bristol entered Balliol College, Oxford. "I was confronted," he wrote, "with the problem whether I should study Latin Hexameters and Greek Iambics or devote myself to what was contemptuously called 'Stinks'." It was a lecture by Prof. Tyndall that determined his choice, and his association with the late Prof. Barr that diverted his physics to industry.

When in July, 1935, the University of Leeds bestowed upon Lord Rutherford and himself the honorary degree of D.Sc., he wrote: "There was Lord Rutherford, the most worthy representative of Pure and Sacred Physics, and here was I, the least worthy representative of Profane Physics," between which and engineering he found it difficult to discriminate, for he was both a physicist and an engineer. How to attain some superlative accuracy from available materials and machines was a question never absent from his mind. For judicious approximation—that characteristic of the skilled engineer—he had a natural gift, but he never acquired the facility in the use of the slide rule of his colleague who, he alleged, in order to multiply two by two, would set these figures on the appropriate scales and, after close scrutiny, declare the product to be 3·96 or 7.

From Balliol, Stroud proceeded to the Universities of Heidelberg and Würtzberg, where, incidentally, he acquired his habit of continuous smoking. Arthur Smithells in the Heidelberger Schloss dared him to smoke a five-pfennig cigar. The results of this unaccustomed experiment were unpleasant. "I determined," he said, "to conquer such squeamishness and eventually achieved such a triumph that up to date I must have smoked over 110,000 cigars—more than half a ton of tobacco—with much satisfaction, and three cigarettes smoked simultaneously in parallel with no satisfaction whatever."

Soon after Stroud's return to England, the Yorkshire College of Leeds in June 1885 lost, by resignation, two of its professors, Sir Edward Thorpe and Sir Arthur Rücker. His friend, Prof. Smithells, was appointed to the vacant chair of chemistry and he, at the early age of twenty-five years, succeeded Sir Arthur Rücker as Cavendish professor of physics. This chair he occupied with great distinction until 1909, when he retired in order to devote his whole attention to the rapidly expanding business he and his partner had established in Glasgow.

During his first session, Stroud thought it necessary to discourse with what he termed "the best Professional dignity he could summon to his assistance". From the results of the terminal examinations he was, however, dismayed to find "that most of the students had learned next to nothing from my lectures". "I resolved," he said, "that the Pontifical Pomposity to which I had been accustomed would be a thing of the past." How well he succeeded in teaching physics effectively with inspiring geniality will always be remembered by his many students, to whom he was affectionately known as 'Billy'.

It was at the Yorkshire College that he met the colleague of his lifetime, the late Archibald Barr, the occupant of the chair of engineering at Leeds and later at Glasgow. Their collaboration in the invention of the rangefinder and many other valuable appliances has already been recorded in the obituary of Prof. Barr (NATURE, **128**, 294; 1931) and is well known. The power of assessing conditions and of rapid readjustment was an outstanding characteristic of Prof. Stroud in all his activities, whether physical, practical or financial, for in all these spheres he was eminently successful. For any problem his penetrating mind would produce not merely one but several solutions and each with its variations. His letters from Leeds abound with coloured sketches of diagrams and mechanisms and such expressions as "Undoubtedly this is the way to do it.—A still better way is this—". "Try turning the mechanism inside out." Gifted with eloquence, he was sparing of unnecessary words. Invariably his letters ended with "Y.v.t., W.S."

By his death, science and industry have lost a very great man.

JAMES WEIR FRENCH.

Dr. C. C. Edgar

WE regret to record the sudden death of Dr. Campbell Cowan Edgar, distinguished as an authority in Egyptian archæology, which took place on May 10 at Berkhamsted.

Dr. Edgar, who was of Scottish extraction, entered Oriel College as a scholar in 1891, and later was attached to the Egyptian Department of Antiquities,

where he became acting head of the Musée des Antiquités in Cairo. He contributed a large number of articles to the "Catalogue Général des Antiquités Egyptiennes du Musée du Caire", dealing with the development of various aspects of Greek art and culture, more especially under the influence of its Egyptian environment. By these studies he came to be recognized as one of the first authorities on the culture of Græco-Roman Egypt. His knowledge and reputation marked him out as well fitted, notwithstanding his lack of specialized training, to undertake the editing of the Zenon archive, an extensive collection of papyri found at Darb-el-Gerza (Philadelphia) in the Fayum, which had been acquired from time to time by the Cairo Museum. A selection published in the "Annales du Service" was speedily and widely accepted as authoritative, and fully justified his selection for the task. This verdict was confirmed by the four volumes afterwards published by him in the "Catalogue Général". Detailed knowledge of the second Ptolemy's scheme of land development in the Fayum is largely due to Edgar's commentary.

On his retirement, Edgar continued his papyrological work and was associated with the late Dr. A. S. Hunt in his work on the Tebtunis papyri. He had also undertaken the editing of the portions of the Zenon papyri in the possession of the University of Michigan and the Rylands Library, Manchester. He acted in an advisory capacity for Græco-Roman Egypt in the editing of the *Journal of Egyptian Archæology* and was a member of the committee of the Egypt Exploration Society. His services to papyrology and Egyptian archæology received the recognition of the honorary degree of Litt.D. from the University of Dublin.

WE regret to announce the following deaths:

Prof. W. A. Bone, F.R.S., formerly professor of chemical technology in the Imperial College of Science and Technology, on June 11, aged sixty-seven years.

Mr. B. D. Burtt, survey botanist in the Department of Tsetse Research, Tanganyika Territory, on June 8.

Mr. M. J. R. Dunstan, O.B.E., principal of the South-Eastern Agricultural College, Wye, in 1902–22, and of the Royal Agricultural College, Cirencester, in 1922–27, on May 28, aged seventy-four years.

Dr. W. W. Campbell, For. Mem. R.S., president of the University of California in 1923–30, director of the Lick Observatory in 1901–30, on June 14, aged seventy-six years.

Mr. A. W. Shorter, assistant keeper of the Department of Egyptian and Assyrian Antiquities in the British Museum, on May 31, aged thirty-two years.

Dr. Sinclair Smith, physicist at the Mount Wilson Observatory, on May 18, aged thirty-nine years.

Mr. C. F. M. Swynnerton, C.M.G., director of tsetse research in Tanganyika Territory, on June 8, aged sixty years.

News and Views

King's Birthday Honours List

THE list of Birthday Honours conferred by H.M. the King includes the names of the following men of science and others associated with scientific work: *Order of Merit:* Sir Arthur Eddington. *Baron:* Sir Josiah Stamp. *Baronets:* Major Sir William Prescott, chairman of the Metropolitan Water Board; Lieutenant-Colonel Sir Archibald Weigall, chairman of the Royal Empire Society. *G.C.M.G.:* Lord Harlech, lately Secretary of State for the Colonies. *K.C.B.:* Sir Cyril Hurcomb, chairman of the Electricity Commission. *K.B.E.:* Prof. T. H. Easterfield, formerly director of the Cawthron Institute of Scientific Research, New Zealand; Sir Samuel Hordern, president of the Royal Agricultural Society, New South Wales; Mr. A. W. Street, First Deputy Under-Secretary of State, Air Ministry, lately Second Secretary, Ministry of Agriculture and Fisheries. *Knights Bachelor:* Mr. W. G. Ball, surgeon and dean of the Medical College, St. Bartholomew's Hospital; Mr. W. A. Cosgrave, lately chief commissioner of the Andaman and Nicobar Islands; Dr. Cyril Norwood, president of St. John's College, Oxford; Mr. W. Roberts, manager of the British Cotton Growing Association Farm, Khanewal, Multan District, Punjab; Dr. R. B. Wade, president of the Medical Board, New South Wales.

C.B.: Dr. J. J. Fox, Government chemist. *C.M.G.:* Mr. G. A. Jones, commissioner of agriculture, Imperial College of Tropical Agriculture, Trinidad; Prof. A. E. V. Richardson, deputy chief executive officer, Council for Scientific and Industrial Research, Commonwealth of Australia; Mr. J. W. Spiller, chief engineer, Designs Branch, Crown Agents for the Colonies. *C.I.E.:* Lieutenant-Colonel E. H. V. Hodge, professor of medicine, Medical College, Calcutta, and first physician to the College Hospitals, Bengal; Mr. H. S. E. Stevens, secretary to the Government of Bengal in the Agriculture and Industries Department, Bengal; Mr. T. A. Whitehead, chief conservator of forests, Madras. *C.B.E.:* Mr. H. Bishop, assistant chief engineer, British Broadcasting Corporation; Mr. W. W. Henderson, director of veterinary services, Nigeria; Dr. Elizabeth Hurdon, lately director of medical services and research, Marie Curie Hospital, Hampstead; Prof. B. Melvill Jones, Francis Mond professor of aeronautical engineering, University of Cambridge; Mr. E. J.

Wayland, director of geological survey, Uganda; Mr. E. B. Wedmore, director and secretary, British Electrical and Allied Industries Research Association.

O.B.E.: Dr. N. Ahmad, director of the Technological Laboratory, Matunga, Bombay; Lieutenant-Colonel Ambuj Nath Bose, professor of pathology, Prince of Wales' Medical College, Patna, Bihar; Dr. G. Bryce, assistant director of agriculture, Nigeria; Mr. J. W. Cassels, director of agriculture, County Durham; Dr. S. E. Chandler, principal of the Plant and Animal Products Department, Imperial Institute; Mr. P. M. Cooper, chairman of Water Commission, Jamaica; Mr. H. M. Gardner, conservator of forests, Kenya; Prof. R. M. Gordon, director of Sir A. L. Jones Research Laboratory, Freetown, Sierra Leone; Mr. A. P. F. Hamilton, deputy conservator of forests, Hoshiarpur Siwaliks, Punjab; Dr. R. B. Jackson, malariologist, Medical Department, Hong-Kong; Mr. A. R. Lambert, inspector, Plant Observation Section, Gezira Agricultural Research Service, Sudan Government; Mr. H. G. Mundy, secretary, Department of Agriculture and Lands, Southern Rhodesia; Mr. R. O'F. Oakley, principal, Department of Scientific and Industrial Research; Mr. D. Robinson, superintending examiner, Patent Office, Board of Trade; Captain J. C. A. Roseveare, chief drainage engineer, Ministry of Agriculture and Fisheries; Mr. B. S. Smith, superintending scientist, Anti-Submarine Establishment, Portland; Dr. A. W. Turner, senior bacteriologist, Animal Health Division, Council for Scientific and Industrial Research, Commonwealth of Australia; Mr. A. E. White, principal of Shrewsbury Technical College; Mr. D. W. Young, deputy surveyor of the New Forest, Forestry Commission. *M.B.E.:* M. R. Ry. Krishnaswami Ayyar Ramayya Avargal, paddy specialist at the Agricultural College and Research Institute, Coimbatore, Madras; Mr. H. L. Dutta, deputy director of agriculture, Orissa; Mr. W. G. Leckie, senior agricultural officer, Kenya; Dr. S. K. Mitra, professor of physics, University of Calcutta; Mr. C. H. Norton, district commissioner, British Guiana; Mr. V. P. Sondhi, geologist, Geological Survey of India. *I.S.O.:* Mr. F. Jenner, district commissioner, Basutoland; Mr. A. Percival, surveyor-general and chief property officer, Department of the Interior, Commonwealth of Australia; Mr. A. H. D. le P. Trench, senior coffee officer, Kenya.

Sir Arthur Eddington, O.M., F.R.S.

THE appointment of Sir Arthur Eddington by His Majesty the King to the Order of Merit will be warmly acclaimed by scientific workers in every corner of the globe as a fitting reward for a series of remarkable achievements in the realms of astronomy and theoretical physics. Senior wrangler and fellow of Trinity College, Cambridge, Eddington entered the scientific world, as chief assistant at the Royal Observatory, Greenwich, at the beginning of a new epoch in astronomy; Kapteyn had made his discovery of star-streaming in 1904 and within a few months Eddington contributed his first important investigation on this subject, to be followed in 1910 by his classic treatment of the proper motions of the naked-eye stars. In 1913, Eddington succeeded Sir George Darwin in the Plumian chair of astronomy at Cambridge, and in 1914 he was appointed director of the Cambridge Observatory in succession to Sir Robert Ball. Between 1913 and 1915, Eddington published several outstanding papers on the dynamics of stellar systems, which are still unsurpassed as models of mathematical elegance and astronomical insight. Relativity and the internal constitution of the stars next, and almost simultaneously, claimed his attention. In the former subject he is recognized, next to Einstein himself, as the foremost authority and investigator. The latter subject is of his own creation and has attracted many of the most eminent astronomers to a fruitful field of research. Within recent years, Eddington's researches have been devoted to the theory of the expansion of the universe and to the interrelation of quantum mechanics and relativity. Eddington's scientific influence is world-wide; his mathematical books are standard works; his popular books have brought delight and understanding to innumerable readers, scientific workers and laymen alike, and have influenced in a remarkable way the currents of recent philosophical thought.

Prof. E. S. Goodrich, F.R.S.

ON June 21, Prof. E. S. Goodrich celebrates his seventieth birthday, in honour of which he is being presented with a volume of "Essays on Evolution" by his colleagues and pupils. Starting his career at University College, London, he followed Sir Ray Lankester to Oxford in 1891, where he has occupied the Linacre chair of zoology and comparative anatomy since 1921. His contributions to zoology, and especially to morphology, are too well known to require detailed enumeration here. Mention should, however, be made of his classical researches on the nephridia and genital ducts, the Stonesfield mammals, the auditory ossicles, the segmentation of the vertebrate head, his general work on the structure and development of vertebrates, and his interpretative studies of the problems of homology, heredity, development and evolution. It is to be noted further that by his work and his teaching he has preserved and encouraged interest in the problem of form, which, now that experimental methods are available for biological studies, is more essential than ever as a starting-point and an objective for research in the newest branches of biology. We offer Prof. Goodrich our most sincere congratulations.

Prof. Irvine Masson, M.B.E.

As announced elsewhere in this issue (p. 1112) Prof. Irvine Masson has been elected to the office of vice-chancellor of the University of Sheffield, which is about to become vacant owing to the retirement of Dr. A. W. Pickard-Cambridge. Prof. Masson was born in 1887, the son of the late Sir David Orme Masson, vice-chancellor of the University of Melbourne, and grandson of Prof. David Masson, the well-known professor of English at Edinburgh. He has been professor of chemistry and head of the Department of Pure Science in the University of Durham since 1924. He was educated at Melbourne

Grammar School, the University of Melbourne, the University of Edinburgh, and the University of London, and is a doctor of science of the University of Melbourne. He was lecturer and reader in chemistry at University College, London, before and after the Great War, while in 1915–19 he was at the Research Department, Royal Arsenal, Woolwich. From 1921 until 1924 Prof. Masson was secretary of the Chemical Society, and he was a member of the Senate of the University of Durham in 1930–36. He is a member of the Council of the Institute of Chemistry and of the Council of the Universities' Bureau. He gave the Alexander Pedler Lecture of the British Science Guild in 1931, when he spoke on "Problems in the National Teaching of Science". His published work includes "Three Centuries of Chemistry" (1925), papers on physical, inorganic and organic chemistry in the journals of the Royal Society, Chemical Society, etc., and occasional bibliographical studies in the *Transactions of the Bibliographical Society*.

Earthquake of June 11

AT 11.58 a.m. (G.M.T.) on June 11, an earthquake of unusual severity was felt all over Belgium and Holland, in the south-west of Germany, the north-east of France and the south-east of England. From the early accounts, the intensity of the shock seems to have been greatest in the west of Belgium, where buildings were slightly damaged, several persons were injured and one was killed. In France, it was most severe in the district around Lille, where many chimneys were thrown down, and at Roubaix, close to the Belgian frontier, where about twenty persons were injured. It was felt also at Boulogne and Paris and, it is said, at Strasbourg. It was observed all over Holland, though but slightly in the north and east of that country. In the south-east of England, especially in Kent, the earthquake was felt rather strongly and also at places so far from the origin as London, Ipswich and Brighton. The disturbed area must therefore have been at least 380 miles long from east to west and 330 miles wide, and have contained not less than 100,000 square miles. It is difficult at present to assign the position of the epicentre. It may have been under the North Sea near the coast of Belgium, or on land in the west of that country. The earthquake was clearly of less intensity than that of April 6, 1580, but, though many of the places disturbed by both shocks are the same, its epicentre must have lain some distance to the east of that of the earlier earthquake, which, as Mr. E. R. Ockenden has shown (NATURE, **138**, 472; 1936) was probably submarine and near the east coast of Kent.

Commemorative Window at the Old Ashmolean, Oxford

ON June 11, in the Museum of the History of Science, Oxford, the new window commemorating the gifts of the Mercers', Grocers' and Merchant Taylors' Companies, the Royal College of Physicians and of the Friends of the Old Ashmolean, was unveiled by the Vice-Chancellor in presence of a large and representative audience. Before the unveiling, speeches were made in the Divinity School by Sir Cecil Clementi, Sir Henry Norbury, Dr. R. Hutchison and Dr. G. D. Parkes and also by the Vice-Chancellor. The new window is placed at the bottom of the staircase of the Museum next to a similar window unveiled by Lord Birkenhead about nine years ago. At the top is represented the arms of Dr. R. T. Gunther, the present keeper and virtual founder of the Museum as it has now become. Below this are represented the arms and crests of the City Companies mentioned and the arms of the Royal College of Physicians.

Meyerstein Institute of Radio-Therapy

THE Meyerstein Institute of Radio-Therapy at the Middlesex Hospital, London, was opened by Sir William Bragg on June 9, before a large audience with many representatives of medicine and science. Sir William Bragg referred in reminiscent terms to the early days of X-rays and radioactivity, pointing out the ever-growing interest in the quest of the invisible phenomena about us. The Institute which he declared open is at the north end of the original Cancer Wing of the Hospital, four floors of which have been reconstructed and adapted to radiological work. The main equipment consists of four X-ray installations having Metropolitan-Vickers tubes actuated at 250 kilovolts, four Newton and Wright sets of oil-cooled Siemens tubes to be run at 200 kilovolts, and a 4-gram radium unit, the radium being automatically transferred to a large radium safe surrounded by 10 inches of lead when not in actual use upon patients. The protection of the personnel has been carefully studied throughout the entire working arrangements. The layout of the Institute is of a very pleasing as well as efficient character, being well ventilated and lighted, with ample space and air for patient and operator alike. The whole policy has been to provide trustworthy apparatus with the best possible conditions under which a selected staff can pursue radiological investigation.

East Malling Research Station

THE purchase by East Malling Research Station of the adjoining property of Bradbourne will provide a background of more than ordinary interest for the future activities of the Station. Originally a moated Tudor house built around an open courtyard, Bradbourne was transformed in the early eighteenth century into a typical Queen Anne mansion. From the Station's point of view, the estate of 200 acres is an even more important acquisition than the house itself, providing opportunity for future development of field experiments under conditions which are typical of much of the fruit-growing land in Kent. The open ground in the district has already been largely built over, and had Bradbourne been allowed to suffer a similar fate, the expansion of research activities of the Station in future years might have been seriously hampered. The prompt action taken by the committee in securing the estate when it came into the market has met with encouragement and support from the Government and from several important public bodies including the National Trust, the Council for the Preservation of Rural England,

the Pilgrim Trust, and the Society for the Protection of Ancient Buildings. An enterprise of this nature which will mean at one and the same time the safeguarding of land for the development of scientific research and the preservation of a green belt in an area rapidly becoming industrialized, should have a double appeal: to those who think well of East Malling as a research centre, and to those also who approve of keeping part at least of the 'Garden of England' unspoilt. Such a project as the purchase and maintenance of Bradbourne must necessarily entail a heavy strain on the Station, and it may be several years before it is free from financial anxiety. Hence any contributions towards paying off the debt for the purchase and restoration will be welcomed by the Director, East Malling Research Station, Near Maidstone, Kent.

B.M.A. Committee on Mental Health

THE ever-recurring problems of sickness both in industry and in the general population which cannot be satisfactorily diagnosed or relieved by reference to the bodily symptoms alone, has led to a slowly developing interest into the mental aspect of disease. More than ten years ago, a report of the Industrial Health Research Board gave experimental evidence that led to the view that telegraphists' cramp was a psycho-neurotic manifestation. Studies of industrial sickness-absence show that much inefficiency, lost time and unhappiness are related to disorders of the type vaguely labelled nervous breakdown. Also investigations into industrial failures show that a large proportion are people whose disabilities are of a mental or emotional nature. It is therefore opportune that a special committee of the British Medical Association should be appointed to study the problem of mental health in general. The committee is to make a thorough study of all the available statistics and will seek to compare the importance of mental illness with other conditions already recognized by the State as requiring action. It will consider the part which the general practitioner, hospitals, clinics under the Mental Treatment Act, child guidance and other clinics, can play in the prevention of such illness, and study the degree of success attainable by the present available methods of treatment. A very important part of the committee's work will be to consider the part allotted to psychological medicine in medical training. The members of the committee are as follows: Sir Robert Johnston (president), Sir Kaye le Fleming (chairman of council), Mr. H. Guy Dain (chairman of representative body), Mr. N. Bishop Harman (treasurer), Sir Henry Brackenbury, Dr. J. A. Brown, Dr. Millais Culpin, Dr. R. G. Gordon, Sir Walter Langdon-Brown, Dr. Mary C. Luff, Dr. E. Mapother, Dr. Doris M. Odlum, Dr. A. A. W. Petrie, Dr. J. R. Rees, Dr. Benjamin Reid, Dr. D. Stewart, and Dr. R. M. Stewart.

Bureau of Human Heredity

AN appeal for funds on behalf of the Bureau of Human Heredity, which appears in *The Times* of June 7, gives some slight indication of the value of the work which has been carried out by this organization with the limited resources at its disposal and in the brief period since its foundation. The function of the Bureau is to centralize in one organization as a world clearing-house the information already accurately ascertained on the inborn constitutional factors in man, and to distribute it freely wherever it is required. In less than eighteen months the Bureau has accumulated data on the inheritance of more than six hundred physical and mental differences. As a result of a financial appeal in May 1936, the Bureau secured sufficient support to enable it to carry on from day to day, while a grant for one year was made by a scientific worker. The present appeal is headed by Lord Dawson of Penn, with the support of Sir F. Gowland Hopkins, Sir E. Farquhar Buzzard, Sir Richard Gregory and others. In their view, the facts warrant an appeal to the public for a sum of £25,000, an amount which is not considered excessive in view of the importance of the work to be carried on. It would enable the activities of the Bureau to be placed on a permanent basis. In justification, the signatories to the appeal point out that attempts to improve the lot of the individual must remain largely ineffective so long as the data which reveal his inborn nature remain obscure. When the Bureau has been placed in a position to carry out its functions normally in accordance with the intentions of its promoters, it will be possible for any medical man to obtain in English the latest information from any country relating to, for example, the resistance or non-resistance of certain types to common infections, or occupational disease. Research workers themselves are well aware that the organization of knowledge, such as that upon which the Bureau is engaged, is little less important for scientific progress than research itself. Without it there is risk that much valuable work may suffer oblivion. The appeal is issued from the Bureau of Human Heredity, 115 Gower Street, London, W.C.1.

Haslemere Educational Museum

THE Haslemere Educational Museum will celebrate, on June 29, the fiftieth anniversary of its foundation. The speakers on the occasion will be Earl Winterton and Dr. John Ramsbottom. This museum was founded in 1888 by Sir Jonathan Hutchinson, F.R.S., at a time when the majority of the smaller museums were stagnant and uninspiring because they lacked teachers. Hutchinson was a great teacher, and through his teaching the museum at his country house at Inval, about a mile from Haslemere, quickly made its influence felt. There he arranged for the first time the space-for-time schedules of geology and human history which are still a special feature of the museum, and these schedules were largely used in his lectures to friends and to members of the Haslemere Natural History Society. In less than ten years the Museum had completely outgrown itself, and Hutchinson then built a much more commodious one in Haslemere on the hillside to the south-east of the town, and there continued to lecture at week-ends in the summer months.

In 1897, Mr. E. W. Swanton became curator of the Museum and still holds that office. The founder died in 1913; no provision had been made for its future, and it was taken over by a committee with Sir Archibald Geikie as chairman. From that time to the present, the necessary funds to allow the work to continue have been subscribed year by year chiefly by local residents. As its activities steadily increased, it became more and more desirable that the Museum should be moved to a central position. In 1925 the committee purchased an old house with beautiful grounds in Haslemere High Street; new galleries for the adequate display of the space-for-time schedules were added and the collections removed there in 1926. Afterwards a new gallery was added to contain a valuable gift of British birds. Through grants from the Carnegie United Kingdom Trust, the work has been extended to include a regional and ecological survey of the district. The value of the Museum as a teaching centre is widely known. Every autumn mycology students from the University of Oxford make it their headquarters. A course in field biology held at Whitsun attracted students from a wide area.

Hittites in Northern Syria

Once more Sir Leonard Woolley's archæological investigations in the East have produced unanticipated results. In his dispatch from Atchana in Northern Syria (*The Times*, June 13), which covers the work of his expedition during the first half of the current season, he records that two hundred inscribed tablets have been found, which reveal for the first time the existence of a strongly established and highly organized Hittite power in Northern Syria at about 1600 B.C., at least two centuries before the great expansion of the Hittite Empire, centring on Hattusas (Boghaz Keui) beyond the Taurus, in what is now Anatolia, with which scholars were previously familiar from excavation and inscribed records. These archives are part of the official documents removed from the Hittite palace, of which a preliminary examination was made at the close of last year's excavations, and now shown to have been destroyed by fire, presumably accidental, as the contents of the building had been removed. The most striking feature of the building, in the account given by Sir Leonard, is the skilled arrangement and the elaborate character of the accommodation. The ruins, still standing to more than a man's height, cover more than 22,000 square feet. Access to the building is from an open courtyard and through a great entry into an entrance hall, from which doorways right and left give admission to the business and residential quarters of the palace respectively. These were virtually separate buildings without intercommunication, and the difference in their character and arrangement indicate their entirely different purposes. In the residential quarter, intended, Sir Leonard thinks, for important members of the palace personnel—the royal family being accommodated above, and the domestic staff, equipment and stores being housed in the courtyard in front of the entry—the accommodation consisted of suites, each of which contained a good-sized bathroom and lavatory. The whole arrangement and content of the palace is, as Sir Leonard remarks, eloquent of a strong and stable government; while the pottery, ivory and gold work bear witness to relations with Cyprus, Crete, Phenicia and the Greek mainland, as well as with Egypt and Mesopotamia.

The Unity Schools

The fifteenth Unity School was held at Jordans Hostel in Bucks, on May 20–23. The general subject was the need and the relation of philosophy to the social sciences, and an introductory address on that topic was given by Prof. Morris Ginsberg, on the evening of May 20. On May 21, Mr. F. S. Marvin introduced the central subject of "What we mean by Social Justice", and the liveliness of the discussion showed clearly how deeply the current thinking on these questions goes, and how much it needs clarification and, so far as possible, harmonization. Dr. C. H. Desch introduced the question of the comparison of our approach to truth in physical and social science, and Prof. Herbert Dingle gave a parallel statement. In particular the question was raised, and viewed from several angles, of whether it is possible in social science properly to speak of a scientific experiment. On May 22, Prof. J. H. Muirhead gave a carefully prepared and moving discourse on the place of the State in relation to right and justice, with the title, "State Law and Individual Morality". The programme, as originally drawn up, was concluded on the Sunday evening by a historical review by Dr. A. J. Carlyle of the various larger subjects which had occurred in the earlier debates—justice, law, sovereignty and the freedom and equality of men—mainly as they are treated in the codes and writings of Greeks, Roman jurists and medieval thinkers. In view of the great success and obvious usefulness of such gatherings, the possibility of extending them to a larger number of people, more frequent occasions and a still wider expanse of subjects is being considered. Further information on the Unity Schools can be obtained from Mr. F. S. Marvin, Pantiles, Coneydale, Welwyn Garden City, Herts.

Correct Street Lighting

The General Electric Co. Ltd. has installed in its street-lighting showrooms at Magnet House, Kingsway, London, W.C.2, a model demonstrating many of the problems that arise in street lighting and how they have been effectively solved by the methods recommended in the final report on street lighting issued by the Ministry of Transport. The model measures 5 ft. long by 2 ft. wide, the lighting columns and roads being to a scale of 1 in 380. Running the whole length of the model is a main arterial road lighted by columns which in practice would provide a mounting height to light source of 25 ft. for a main road (Group *A*). The thoroughfare is lighted by a staggered arrangement of units not more than 150 ft. apart. In every third position an auxiliary unit is centrally suspended, so that there can be adequate lighting down and across what would otherwise be a dark central section of the road. After a roundabout,

there is a dual carriage way and it is emphasized how necessary it is to treat dual carriage ways as if they were two separate roads. When the dual road bends away in the country from the 'roundabout', the lighting points become closer on the outside of the bend. Cross-road lighting treatment is also shown in several places. Lights here are arranged just beyond the crossing on the left-hand side as the traffic proceeds; then traffic moving at right angles and pedestrians preparing to cross the road become clearly visible. In addition, photographs are shown to illustrate the more important features demonstrated by the model and suggested in the recommendations. A fuller description of this model is given in the *Osram G.E.C. Bulletin* of May 1938.

Short-Circuit Testing Stations

ABOUT ten years ago it was found necessary to build short-circuit testing stations in order to find out the true rating for a large switch or current-breaker. In order to find out how a switch will break a large electric current at a low voltage or a current at a very high voltage, different methods have to be used and special large and expensive devices are necessary. It is very unsatisfactory to assign nominal ratings based on theoretical design considerations and experience gained by similar apparatus. The International Electrotechnical Commission has now published a specification for the short-circuit testing of circuit-breakers, and manufacturers have to issue a certificate with the apparatus stating that it has passed the required proving tests. Eight years ago Messrs. Reyrolle and Co. built the first short-circuit testing station at Hebburn-on-Tyne and since then, two more have been erected in Great Britain and others are being constructed or are under contemplation. According to the *Electrical Power Engineer* of December last, the certification of switches is not exclusively confined to those manufacturers who own testing stations in whole or in part. The facilities of all the British proving stations are open to other manufacturers for making tests. This entails a definite assurance from the testing stations of privacy in testing and secrecy of results of experiments making so much noise and requiring so large a space. All work is carried out on apparatus under a reference number, the manufacturer's name being omitted and also the designation of the apparatus. During testing all entrances to the station are locked. A separate office is provided for the use of customers wishing to discuss reports. Sometimes cinematograph films of the tests are shown at these offices.

Paris Academy of Sciences

THE "Annuaire" of the Paris Academy of Sciences has for some years past included a biographical index of past and present members and *correspondants* of the Academy. In this year's volume (Paris: Gauthier Villars, 1938), this index is considerably enlarged; notes have been added indicating the subject or subjects in which each individual was particularly interested, and the list of names has been augmented by including the members of the older body, the Royal Academy of Sciences (1666–1795). A paper read by Prof. Alfred Lacroix, one of the permanent secretaries of the Academy, at the meeting held on January 4 last (*C.R.*, **206**, 23), explains the changes that have been made and describes briefly the various previous attempts to provide a complete statement of past and present members of the Academy. The archives of the Academy now have a separate file for each individual who has been connected with it, and every effort is being made, by searching national, parish and other records, to ensure that biographical details are correct. Further, by dint of most painstaking research, the documents relating to the proceedings of every meeting of the Academy, apart from biographical material, have been classified and they are now also arranged in files, one to each meeting from that of "6 nivôse an IV" (December 27, 1795). As regards meetings of the Royal Academy of Sciences, there are in the archives 109 large folio volumes of *Procès verbaux* prepared by the five successive permanent secretaries, J.-B. du Hamel, Fontenelle, Dortous de Mairan, Grandjean de Fouchy and Condorcet, which go back to the first meeting on December 22, 1666. The total number of men of science who have belonged to the Academy since 1666 is 2,071 (members, 992; *correspondants*, 1,079); it possesses nearly sixteen hundred autographs and about the same number of portraits.

Curtis's Botanical Magazine

A COMPLETE volume of this beautifully illustrated botanical periodical has recently been published in one cover (*Curtis's Botanical Magazine*, **147**. London: Bernard Quaritch, Ltd. 63*s*. net). This is to fill a gap in the series created by the non-appearance of a volume in 1921. At the end of 1920, publication of the *Magazine* ceased, and it seemed possible that the copyright would pass to an owner in the United States; but in 1921, the Royal Horticultural Society was presented with the copyright through the generosity of subscribers. The gap thus created in the series has now been filled through the generosity of Mr. Reginald Cory, and the volume is dedicated in accordance with his wish to Sir Isaac Bayley Balfour, Sir David Prain and Sir Frederick Moore in recognition of their services to botany and horticulture. Fifty-seven plants are described and beautifully illustrated, including eleven species of *Rhododendron*, fifteen of *Primula* and four of *Gentiana*. Plants from all parts of the world are described in the *Magazine*; but in this volume Chinese plants take pride of place—thirty-eight species; five South African species are described and the rest come from countries so far apart as Peru, Siberia, Japan and Tibet. The method familiar to all readers of this periodical is adopted. The history of each species, so far as it is known, is briefly given, and this is followed by a detailed description of morphology (especially floral) and distribution. The beautifully coloured illustrations of each plant described are, of course, the main feature of the volume. The authoritative nature of the text cannot be questioned. Here one notices such familiar contributors as O. Stapf (seventeen species alone and ten in collaboration either with

C. V. B. Marquand or with F. Ballard), J. M. Cowan (thirteen species), A. B. Rendle (five species), and others including J. Anthony, G. Taylor, W. B. Turrill and T. A. Sprague. The volume is edited by Dr. J. Ramsbottom and does credit to editor and contributors. The price may appear to be high, but the illustrations alone make it good value and a real acquisition to any botanical library.

Biological Effects of Ultra-Sound Waves

A SECTION of Messrs. Hermann's "Actualités Scientifiques et Industrielles" series of publications is being devoted to investigations of the effects of radiation on living organisms; it is under the charge of Prof. N. Marinesco, director of research in the Institute of Physico-chemical Biology, Paris. Two parts dealing with ultra-sound waves and their properties have already appeared: (1) "Proprietes piézo-chimiques, physiques et biophysiques des Ultra-sons. Technique des ondes élastique de haute fréquence", and (2) "Propriétés des Ultra-sons. Destruction des micro-organismes. Préparation des colloides à basses températures. Réactions explosives. Réactions photochimiques". Both are written by Prof. Marinesco. The first 56 pages and 5 plates (15 francs) describes the electro-elastic properties of quartz, the production of stationary waves in liquids, the intensity of the radiation, the pressure it exerts and the absorption it undergoes. The second, of 68 pages and 7 plates (18 francs), describes the effects of ultra-sound waves in sterilizing water and milk, in producing emulsions, in detonating explosives and in accelerating chemical reactions with special reference to those in photography. Many of the plates are reproductions of photographs taken by the author. Bibliographies are provided.

International Union against Cancer

THE Third International Cancer Congress under the auspices of the International Union against Cancer will be held in Atlantic City, New Jersey, on September 11–16, 1939. The president of the Congress is Prof. Francis Carter Wood, director of the Institute of Cancer Research of Columbia University; Dr. Donald S. Childs of Syracuse, New York, is the secretary-treasurer; and Dr. A. L. Loomis Bell of Long Island College Hospital, Brooklyn, New York, is in charge of transportation and exhibits. The proposed sections are as follows: general research; biophysics; genetics; general pathology of cancer; surgery of cancer; radiological diagnosis of cancer; radiotherapy of cancer; statistics; and education. Details concerning section chairmen, committees and other data will be announced later. Further information can be obtained from the Institute of Cancer Research, 1145 Amsterdam Avenue, New York, N.Y.

A Regional Survey Field Service Pocket-book

THE Le Play Society's well-known "Discovery" chart has been revised and enlarged and its subject-matter has been put into pocket-book form with blank leaves for maps and notes. In this form it is published under the title "Exploration" at 4*d*., postage 1*d*. It directs attention to some hundreds of possible fields of local exploration grouped under the major headings: geology, rivers and water-supply, weather and climate, vegetation and open spaces, agriculture, zoology, archæology, history, communications, occupations, folk-lore, place-names, modern and changing conditions, camping and rambling. It is calculated to stimulate youthful zest for exploration and arouse and develop scientific curiosity. An ethical aim is provided by the following passage, appearing on the front page, reminiscent of the teaching of Patrick Geddes and Victor Branford: "If you learn to know your own place well, and in so doing learn to love it more, it will help you to understand and appreciate other places, and to sympathise with their problems". It should prove serviceable to scoutmasters and girl-guides as well as to others engaged in the teaching of local history, local geography and civics and in training for citizenship.

Colonial Service Appointments

THE following appointments and promotions have recently been made in the Colonial Service: R. O. Roberts, field geologist, Uganda; W. L. Stapleton, inspector of mines, Malaya; F. G. Bridges, inspector of plants and produce, Nigeria; M. J. Douglass, agricultural officer, Sierra Leone; J. Ford, entomologist, Tsetse Research Department, Tanganyika Territory; K. S. Hocking, secretary, Tsetse Research Department, Tanganyika Territory; A. R. Jones, meteorological assistant, Sierra Leone; A. G. Robertson, field officer, Tsetse Research Department, Tanganyika Territory; F. L. Vanderplank, field officer, Tsetse Research Department, Tanganyika Territory; E. F. Whiteside, field assistant, Tsetse Research Department, Tanganyika Territory; T. W. Brown (agricultural officer), botanist, Research Branch, Department of Agriculture, Malaya; B. G. A. Low (botanist, Research Branch, Department of Agriculture), agricultural officer, Field Branch, Malaya; F. B. Higgins (senior inspector of mines, Nigeria), senior inspector of mines, Gold Coast; H. H. Cobon (assistant superintendent of surveys), superintendent of surveys, Malaya; F. W. Abbott (laboratory assistant, Medical Department), laboratory assistant, Grade I, Medical Department, Gold Coast; P. A. Clearkin (formerly deputy director of Laboratory Service, Tanganyika Territory), bacteriologist and pathologist, British Guiana (temporary appointment); C. K. Robinson (agricultural assistant), agricultural superintendent, Saint Vincent; G. C. Stevenson (assistant botanist, British West Indies Central Sugar Cane Breeding Station, Barbados), botanist, Sugar Cane Research Station, Mauritius.

Shower of Bright Meteors

A REMARKABLE shower of fireballs is reported to have been seen in southern Sweden on May 27 between $18^h\ 20^m$ and $20^h\ 12^m$ U.T. About $18^h\ 40^m$, two specially bright fireballs, visible in full sunshine, appeared over Bornholm Island. The general direction was from west to east. Further details of these and other fireballs are requested by A. Corlin,

Lund Observatory. It is hoped that sufficient data will be available later to enable the paths to be computed.

Curious Fading of Comet Gale

As announced in NATURE recently, Comet Gale was found on May 1 by Mr. L. E. Cunningham at Harvard, its magnitude being 10. An orbit and ephemeris were computed, and, knowing the distances of the object from the earth and sun, its magnitude on various dates was estimated. The remarkable thing is that its magnitude is considerably less than that predicted, as the following figures will show :

Date	Predicted Magnitude	Observed Magnitude
May 9	9·5	11
28	8·5	11
31	8·4	13

It is probable that some rapid internal changes, on which one can only speculate at the moment, are taking place in the comet.

Announcements

THE Albert Medal for 1938 of the Royal Society of Arts has been awarded to H.M. Queen Mary "in recognition of her Majesty's unremitting interest in arts and manufactures to the great benefit of British industry and commerce". Queen Mary has intimated her acceptance of the medal.

DR. F. W. HAYWOOD has been appointed chief metallurgist to Wild-Barfield Electric Furnaces, Ltd., to take charge of the new research department nearing completion. Dr. Haywood, who is at present engaged with Messrs. I.C.I. (Fertilizer and Synthetic Products), Ltd., at Billingham, will be commencing his duties later in the year.

GEH. REG. RAT HEINRICH KAYSER, emeritus professor of physics at Bonn, and Dr. Hans Horst Meyer, emeritus professor of pharmacology, pathology and biology at Vienna, celebrated their eighty-fifth birthday on March 16 and 17 respectively.

PROF. PAUL FOURMARIER, professor of physical geography in the University of Liège, has been elected a foreign correspondent of the Geological Society of London.

PROF. M. T. BOGERT, professor of organic chemistry in Columbia University, has been awarded the Priestley Gold Medal of the American Chemical Society. The medal, the highest American honour in chemistry, is granted once in three years. It was established in honour of Joseph Priestley. Priestley lived most of his life in England but went to America late in life to escape hostility to his views as a non-conformist preacher. He lived in Philadelphia and Northumberland, Pa. Alone, and in collaboration with his many students, Prof. Bogert is the author of more than four hundred papers in synthetic organic chemistry.

MR. J. REID MOIR will give the next Huxley Lecture of the Imperial College of Science and Technology on May 4, 1939, at 5.30 p.m. The subject of his lecture will be "The Earliest Men".

THE tenth International Medical Congress for Psychiatry will be held at Oxford on July 29–August 2. A detailed programme will be published later. Further information can be obtained from Dr. E. B. Strauss, 81 Harley Street, London, W.1.

A NATIONAL conference on Maternity and Child Welfare will be held in the Great Hall, University of Bristol, on July 5–7, under the presidency of Mr. R. H. Bernays, M.P., Parliamentary Secretary of the Ministry of Health. Further information can be obtained from the Honorary Secretary, Dr. Minett, Carnegie House, 47 Piccadilly, W.1.

THE next meeting of the French Association for the Advancement of Science will be held at Arcachon on September 22–27 under the presidency of M. Guilliermond, member of the Institut de France and professor in the Paris Faculty of Sciences. The subjects for discussion are : (1) the oyster (palæontology, zoology, biology, hygiene, fishing and cultivation) ; (2) the marine pine and its derivatives ; (3) the pigments of living beings (chemical composition and psychological role) (4) biology and protection of fresh water. Further information can be obtained from the Secretary of the Association, 28 rue Serpente, Paris.

THE fifth International Locust Conference will be held in Brussels on August 25–September 1, under the patronage of His Majesty the King of the Belgians. The programme includes discussions on the standardization of studies on phase transformation in locusts ; on methods of studying locust migrations ; on general principles of anti-locust research, etc. The greater part of the programme is devoted to problems of organization of preventive control of locusts and grasshoppers in different natural regions of the world. Information on the Conference can be obtained from the Secretariat, 7 Place Royale, Brussels ; and from the Imperial Institute of Entomology, British Museum (Natural History), London, S.W.7.

WE have received the April issue of *Sands, Clays and Minerals*, a journal edited and produced by A. L. Curtis, Chatteris, which contains a number of interesting papers. One of these deals with the modern uses of tantalum and niobium, another with the reparation of historical buildings, and a third (by A. Barclay, of the Science Museum) is on early technical balances and is profusely illustrated. The journal is of a high standard and contains much information of scientific and economic interest.

ERRATUM. Prof. J. H. Orton writes that in his letter entitled "Life-History of the Salmon (*Salmo salar* L.)" in NATURE of June 4, p. 1017, the word "mature" in the bottom line of column 1 was inadvertently written for the word "immature".

Letters to the Editor

The Editor does not hold himself responsible for opinions expressed by his correspondents. He cannot undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. *No notice is taken of anonymous communications.*

NOTES ON POINTS IN SOME OF THIS WEEK'S LETTERS APPEAR ON P. 1103.

CORRESPONDENTS ARE INVITED TO ATTACH SIMILAR SUMMARIES TO THEIR COMMUNICATIONS.

Packing Fractions of Bromine, Chromium, Nickel and Titanium

I HAVE obtained a new determination of the packing fraction of ^{79}Br by measurements of the doublet given by its triply charged atom and the quintuply charged atom of ^{132}Xe, the value for which has been provisionally given[1]. As the difference in mass between ^{79}Br and ^{81}Br has also been measured[2], values for both isotopes can be calculated as given below. These are provisional only, but are certainly more reliable than those previously in use. I hope in the future to get more accurate results by means of the doublet $^{81}Br^{+++} - C_3H_3$, but this cannot be used now owing to the presence of aluminium in the discharge tube.

Very satisfactory results were obtained with chromium. The volatile carbonyl was used, which when combined with suitable proportions of methyl chloride gave $^{52}Cr - CH_2{}^{37}Cl$ the doublet required. As soon as the initial difficulties of admitting the vapours in the right proportions had been overcome, a great many well-matched doublets were photographed giving very consistent measurements.

Experiments with nickel were disappointing. Nickel carbonyl was used, but the line $^{58}Ni^{++}$ could not be obtained intense enough for comparison with C_3H^5. As the first order line ^{58}Ni was strong, it was considered worth while to compare the ratio of this to CO_2 by means of the fairly near ratio ^{16}O to ^{12}C, using artificial doublets. Four complete sets of comparisons were made, and the mean of these indicates a negative packing fraction considerably smaller than that previously estimated ten years ago by the same method.

The packing fraction of ^{48}Ti has recently been given by Dempster as $-7{\cdot}22 \pm 0{\cdot}1$ by direct comparison of its triply charged atom with the standard oxygen atom[3]. His comparisons of $^{48}Ti^{++++} - C$ were, however, not satisfactory. I have been to great pains to obtain and measure the corresponding doublet $^{48}Ti^{++} - C_2$, as this affords an entirely independent check on the controversial value of ^{12}C. Titanium tetrabromide was used, but is very troublesome in the discharge. The line $^{48}Ti^{++}$ was very feeble and the exposures consequently long, and as there was little possible control on the relative intensities of the lines, only very few of the plates taken were of any value. After many weeks of work, seven reasonably well-matched doublets had been obtained with the mean result given below. If my value 2·96 for the packing fraction of carbon is used, the value obtained is virtually identical with Dempster's; conversely, this agreement provides a further independent and welcome confirmation of my value $12{\cdot}00355 \pm 0{\cdot}00015$ for the mass of ^{12}C. This and H = 1·00812 have been used in calculating these results:

Doublet	Number of doublets measured	Difference in packing fraction	Difference of mass
$^{79}Br^{++} - {}^{132}Xe^{+++++}$	6	$28{\cdot}30 \pm 0{\cdot}3$	0·0745
$^{52}Cr - CH_2{}^{37}Cl$	18	$9{\cdot}22 \pm 0{\cdot}15$	0·0479
$^{48}Ti^{++} - {}^{12}C_2$	7	$10{\cdot}20 \pm 0{\cdot}15$	0·0490

Symbol	Packing fraction	Isotopic weight
^{48}Ti	−7·24	$47{\cdot}9652 \pm 0{\cdot}0008$
^{52}Cr	−8·18	$51{\cdot}9575 \pm 0{\cdot}0008$
^{58}Ni	(−8·35)	$(57{\cdot}9516 \pm 0{\cdot}0020)$
^{79}Br	(−7·4)	$(78{\cdot}9417 \pm 0{\cdot}0020)$
^{81}Br	(−7·4)	$(80{\cdot}9400 \pm 0{\cdot}0020)$

F. W. ASTON.

Cavendish Laboratory,
Cambridge.
June 1.

[1] NATURE, **140**, 149 (July 24, 1937).
[2] NATURE, **137**, 357 (Feb. 29, 1936).
[3] *Phys. Rev.*, **53**, 68 (1938).

Resonance in Nuclear Photo-Effects

IN connexion with the remarkable selectivity of nuclear photo-effects of heavy elements indicated by experiments, it was pointed out in a recent note in NATURE[1] that such photo-effects might provide a means of examining certain features of the mechanism of excitation of atomic nuclei not disclosed by ordinary experience about nuclear reactions by collisions. In fact, the probability of excitation of a nucleus by monochromatic radiation depends on the degree to which forced oscillations of given frequency of the nuclear matter can be produced, and experiments on the variation of the yield of the photo-effects with radiation frequency would therefore allow a direct estimate of the strength of coupling between the different modes of oscillation into which the collective motion of the nuclear particles may approximately be resolved.

In view of the very incomplete experimental evidence, I would like, however, to emphasize the preliminary character of any such estimates as attempted in the note referred to, and at the same time to direct attention to a possible misunderstanding of the argument regarding the separation of the course of the photo-effects into successive stages. Such a separation into the initial excitation of a certain mode of oscillation and its subsequent quenching due to the coupling cannot, of course, be carried out in the case of strictly monochromatic radiation. Nevertheless, a

well-defined meaning can be attached to the argument as soon as we, instead, consider the effect of a time-limited irradiation with a corresponding frequency uncertainty.

In particular it follows from such a treatment that, so far as we are concerned only with mean values of the yield of the photo-effects over energy regions wide compared with the distance of the nuclear levels, all typical resonances will be essentially the same whether the level distribution is discrete or continuous. It follows also that, contrary to an assertion in the note, the selectivity is completely independent of the ratio between the chances of the re-emission of the whole energy as a single radiation quantum in the initial and in the subsequent stage of the excitation process. All such conclusions are in fact in complete harmony with a treatment on the lines of the ordinary theory of dispersion of monochromatic radiation, according to which the selective phenomena would be attributed to an abnormally large radiative transition probability to the normal state from certain energy regions.

For the clarification of these points I am indebted to discussions with Prof. Peierls and Prof. Placzek, in collaboration with whom a paper about nuclear resonance phenomena with special regard to the above-mentioned arguments is being prepared for publication in the communications of the Copenhagen Academy of Sciences.

N. BOHR.

Institute of Theoretical Physics,
Copenhagen.
May 28.

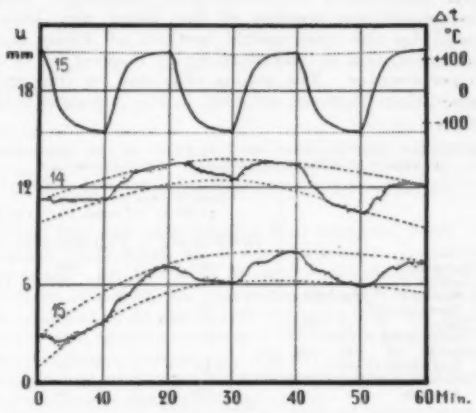
[1] Cf. Bohr, N., NATURE, 141, 326 (1938).

Effects of Gas Ions on the Benedicks Effects in Mercury

IT has been proved by one of us[1] that a thermo-electric force of the first kind—now, with W. Meissner, called the first Benedicks effect—appears in asymmetrically heated homogeneous liquid mercury, with a *negative* sign. (A negative sign indicates that in the external circuit the electron current flows from the hot side of the temperature gradient to the cold one.) As for the reverse effect—the second Benedicks effect (or heat transport caused by an electric current)—it was found by us[2] that this effect likewise was 'negative' in pure mercury containing gas, but *positive* in degassed pure mercury—evidently due to a lowered content of gas ions, already known to influence the sign of this effect in the case of platinum[3]. The conclusion was drawn that likewise a change of the sign of the first Benedicks effect may be caused by a lowered gas content.

In order to test the accuracy of this conclusion, a 'strangulation vessel' of Normal-glass—giving locally a high temperature gradient—filled with carefully degassed mercury, was used. Possible sources of error were carefully considered. From eight series obtained in varying circumstances—all of them in good agreement—two are reproduced in the accompanying figure. The upper curve gives the temperature differences producing the gradient, the lower ones (two series) the corresponding galvanometer deflections (1 mm. = $1{\cdot}16 \times 10^{-9}$ volts). The reproducibility is seen to be fairly good. Most of the periods show an inflection point, due to the fact that the E.M.F. is proportional to the third degree of the temperature difference—this was separately proved.

The main result is, that *the first Benedicks effect in mercury of highest purity is actually a positive one.* The *negative* sign found earlier, consequently, *must be due to the action of gas ions*, as in the case of the second Benedicks effect.



This causes an earlier discrepancy of the periodic table to disappear: while, in its second column, zinc and cadmium have a positive Thomson effect, the following metal, mercury, has always been found to give a negative sign for the Thomson effect. For theoretical reasons, we may now conclude that the Thomson effect of pure mercury quite free from gas will be positive, causing this discrepancy to disappear.

Metallografiska Institutet, Stockholm.
May 18.

C. BENEDICKS.
P. SEDERHOLM.

[1] Benedicks, C., *Ann. Phys.*, iv, **62**, 185 (1920).

[2] Benedicks, C., and Sederholm, P., *Arkiv. f. Mat. Astr. and Fysik (Stockholm)*, A, **25**, No. 22, 1–20 (1936).

[3] Benedicks, C., and Borgmann, C. W., *Arkiv f. Mat. Astr. and Fysik (Stockholm)*, B, **24**, No. 10, 1–5 (1934); Benedicks, C., Borgmann, C. W., and Sederholm, P., *Arkiv f. Mat. Astr. and Fysik (Stockholm)*, A, **25**, No. 9, 1–28 (1935).

Molecular 'Rejuvenation' of Muscle Tissue

THE decomposition of creatine phosphoric acid during muscular action, and its rebuilding during rest, has been the subject of numerous detailed investigations. We were interested in the problem, if, and to what extent, creatine phosphoric acid molecules are decomposed and afterwards rebuilt, or 'rejuvenated', in the resting muscle. This problem can be easily solved by injecting labelled sodium phosphate, for example, into frogs, and determining if, and to what extent, creatine phosphoric acid extracted from the muscle of the frog becomes labelled (radioactive). Phosphorus atoms present in creatine phosphoric acid and other organic compounds do not exchange spontaneously with other phosphorus atoms present, and thus the fact that labelled creatine phosphoric acid can be isolated from the muscle is a proof that this was synthesized after the administration of labelled sodium phosphate.

The muscle was placed at once after removal in liquid air, the acid soluble components extracted with trichloracetic acid kept at − 9°, and the inorganic phosphate present in the solution precipitated as ammonium magnesium salt. The next step was the

decomposition of creatine phosphoric acid remaining in the filtrate from the last-mentioned precipitate. The decomposition was carried out by adding[1] sulphuric acid (1*n*) and ammonium molybdate (1 per cent) to the solution. The phosphate ions were then precipitated as ammonium magnesium salt. The phosphorus content of the latter was determined by the colorimetric method of Fiske and Subbarow, and its radioactivity by making use of a Geiger counter. The results obtained for this and some other fractions are seen in the accompanying table.

PHOSPHORUS ISOLATED FROM FROG KILLED 3 HOURS AFTER SUBCUTANEOUS INJECTION OF LABELLED SODIUM PHOSPHATE.

	Relative specific activity (activity per mgm. P)	
	Frog kept at 2°	Frog kept at 21°
Inorganic P	100	100
Creatine P	49	78
Adenosin P (7 min. hydrolysed at 100°)	50	—
"Hexose" P (30 min. hydrolysed at 100°)	52	78
Product of 100 min. hydrolysis at 100°	45	—
Non-acid soluble residual fraction	9	38

A specific activity of the creatine phosphoric acid phosphorus amounting to 49 per cent of that of the inorganic phosphorus indicates that 49 per cent of the creatine phosphoric acid molecules present in the resting muscle were split and newly synthesized through enzymatic action in the course of the last 3 hours before the frog was killed. As the total number of creatine phosphoric acid molecules present in the muscle can be assumed not to have changed during that time, in the resting muscle we are faced with a molecular rejuvenation of the creatine phosphoric acid to the above extent. The adenosin and the hexosephosphate molecules are rejuvenated to about the same extent as those of the creatine phosphoric acid. With increasing temperature, as is to be expected, the rate of molecular rejuvenation increases, and in the course of less than a day practically all creatine phosphoric acid molecules are renewed.

The new formation of some of the 'acid soluble' phosphorus compounds present in the blood also takes place to a very appreciable extent. In human blood 2 hours after intravenous injection of labelled sodium phosphate, the specific activity of the total acid soluble organic phosphorus, kindly extracted by Mr. A. H. W. Aten from the blood corpuscles, amounted to 20 per cent of that of the plasma inorganic phosphorus.

In experiments *in vitro*[2] in which dog's blood was shaken for 2·5 hours with labelled sodium phosphate, 1/25 of the total acid soluble molecules was found to be labelled and thus split and resynthesized under the action of enzymes. In the same *in vitro* experiments the formation of only very minute amounts of labelled phosphatides (less than 0·1 per cent) could be ascertained. Also in experiments *in vivo* labelled phosphatides were found to be present to an appreciable extent in the blood only after a very long time. The specific activity of phosphatide P extracted from human blood corpuscles 24 hours after administration of labelled sodium phosphate was found to be 40 times less than that of plasma inorganic P, showing the very low rate of rejuvenation of the phosphatide molecules present in the blood.

There is thus a conspicuous difference in the rate of rejuvenation of some low molecular water soluble compounds, as for example, creatine phosphoric acid, adenosin phosphoric acid, hexosephosphate, and non-water soluble products like phosphatides, nucleoproteins and similar compounds, present in the blood. This difference is closely connected with the fact that the first-mentioned compounds are at least partly rejuvenated through enzymatic action in the blood itself, while the latter are principally rejuvenated in the organs and carried from these in the blood stream. The measurement of the rate at which, for example, adenosintriphosphoric acid molecules are renewed can be conveniently used to determine the amount of enzymes the presence of which enables the exchange reaction to take place.

We wish to express our most hearty thanks to Prof. Krogh for all the biological material used, and to him and to Prof. Niels Bohr for their kind interest taken in this work. We wish also to thank Miss Hilde Levi and Mr. Ussing for their assistance.

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O. REBBE.

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and
Zoophysiological Laboratory,
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May 17.

[1] Lohmann, K., *Biochem. Z.*, **194**, 306 (1928).
[2] Hahn, L., and Hevesy, G., *Bull. Lab. Carlsberg*, **22**, 188 (1938).

Adsorption Potentials

Ehrensvärd and Sillén[1] have recently considered the interfacial potential difference between two immiscible or slightly miscible liquid phases containing electrolytes; they conclude that the E.M.F.'s across cells of the type

Calomel electrode	Electrolyte BA in water C_1	Non-aqueous phase	Electrolyte BA in water C_2	Calomel electrode

are not derived from true partition equilibria of the electrolyte between the aqueous phases and the adjoining regions of the oil phase, but from an "*ion adsorption equilibrium* between the aqueous phases and the interfacial layer".

The E.M.F. of a cell is not necessarily affected by the adsorption of ions or neutral molecules at one or more of the interphases. In the system

$$\text{metal } M \mid \text{solution of salt } M^+X^-$$

for example, in thermodynamic equilibrium, changes in the potential difference across the metal - solution interphase are controlled by changes in the chemical potential of the ion M^+ in the solution. If any substance is introduced into the system which is insoluble in the bulk phases and adsorbed at the interphase, no change of potential difference will occur. The added substance is insoluble and can therefore be shown not to alter the chemical potentials of the bulk phase components. If this substance has strongly polar molecules, and forms an oriented layer at the interphase, the distribution of electrical potential and of charged particles in the interphase will be altered by its presence, but no change in potential difference across the interphase will be observed.

There are two conditions in which adsorption potentials can affect the E.M.F. of a cell:

(1) When the interphase contains a boundary across which no charged particle can pass.

(2) When diffusion of ions as well as of non-ionized molecular species takes place across an interphase which is not in a state of equilibrium.

Type 1 maintains a constant charge on its double layer when left on open circuit. For solutions of a given composition, it takes up any potential which is initially imposed. It has no definite potential of its own; but changes in the composition of the solution at constant surface charge produce definite changes of potential which depend on the actual charge on the double layer. These changes of potential arise from the adsorption at the interphase of substances from the solution. The theory of adsorption at interphases of this type has been worked out by Stern[2], who assumes the validity of Langmuir's adsorption isotherm for such cases. An examination of the partition function for an interphase shows that this assumption is not valid for charged particles[3], but the general basis of Stern's theory is supported by work on dropping mercury electrodes and electrocapillary data[4].

Adsorption at interphases of Type 2 will result in general in altered diffusion rates, and may alter these rates differently in the case of different ions. Since the diffusion of neutral electrolytes, interchange of cations and interchange of anions all involve the superposition of electric currents flowing in opposite directions, a selective change in the rates of ionic diffusion may lead to a modified distribution of electric charge. Thus the interfacial potential difference will alter.

The formula for a diffusion potential may be written approximately as:

$$\Psi_\beta - \Psi_\alpha = -\sum_{i=1}^{i=s}\int_\alpha^\beta \frac{t_i}{z_i F}\,.\,d\mu_i \quad \ldots\ldots\ (1).$$

The integration is from homogeneous solution α to homogeneous solution β on the other side of the diffusion boundary, and all the terms have their usual thermodynamic significance. As $\mu_i = \mu_{oi} + RT \ln c_i f_i$ and μ_{oi} is a constant depending on the temperature, pressure and nature of the solvent, attempts to relate equation 1 to ionic concentrations when water and oil are diffusing into each other involve a consideration not only of the diffusion of each ion but also of the solvent; diffusion of the latter causes the partition coefficients to vary both in space and in time.

As the cells examined by Ehrensvärd and Sillén take up definite potentials, their aqueous - oil interphases cannot be of Type 1. They claim that their observations are consistent with the theory of such an interphase. The early stages of the setting up of a diffusion gradient in oil-water interphases seem therefore to confine the diffusion to the first one or two molecular layers of the oil phase. For these layers, interchange equilibrium is rapidly set up. The subsequent extension of the region of diffusion into the non-aqueous phase is very slow. Kinetically, therefore, a continuous transition can take place from an adsorbed monolayer to a diffusion gradient. Mathematically, Equation 1 is formally valid for a completely polarizable interphase.

S. R. CRAXFORD.
Cambridge. O. GATTY.
May 17. ROTHSCHILD.

[1] Ehrensvärd, G., and Sillén, L. G., NATURE, 141, 788 (1938).
[2] Stern, O., *Z. Elektrochem.*, **30**, 508 (1924).
[3] Levine, S., personal communication.
[4] Philpot, J. St. L., *Phil. Mag.*, **13**, 775 (1932); Craxford, S. R., Dissertation, Oxford, 1936.

An Anomalous Case of Emulsification

IT is commonly supposed that an emulsion of two immiscible liquids is stabilized by the formation of an interfacial film of emulsifying agent molecules which, by their constitution and orientation, condition the emulsion type. Thus, according to the Gibbs' equation, those materials which reduce surface or interfacial tension should facilitate emulsification. Indeed the term surface tension depressor has become synonymous with emulsifying agent.

It has recently come to our notice that simple inorganic salts such as the alkali halides enable relatively stable emulsions of water in amyl alcohol to be produced. These salts are not surface active but tend rather to *increase* the interfacial tension of the system.

The stability of emulsions thus prepared bears no simple relationship to the concentration of salt in solution. In the case of emulsions stabilized by potassium iodide, the maximum stability appears to be attained at an electrolyte concentration of 0·05 *N*, while concentrations greater than normal inhibit emulsification completely. On the other hand, concentrations of potassium iodide so low as 0·001 *N* have considerable stabilizing action.

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May 20.

Control of Insects by Methallyl Chloride

IT is difficult to control insects in stored products, where they cause millions of pounds worth of damage annually. The most efficacious method is by fumigating them with poisonous gases or vapours. Many chemical compounds have already been tried, for example, by the United States Department of Agriculture[1].

I carried out some investigations upon methallyl chloride, and found that this material possesses good insecticidal qualities. It is a product manufactured from petroleum hydrocarbons and has the following formula:

$$CH_2=C(CH_3)-CH_2Cl$$

Its specific gravity at 20° C. is 0·925 and its boiling point 72° C. It is a colourless liquid which evaporates easily at normal temperature. Mixtures of its vapour with air are not explosive in concentrations of 105–339 gm. per cub. m. It was H. F. Zimmermann at Prague who directed my attention to this product. It was found in the laboratory that species of *Ephestia* such as *E. kuhniella* Zeller and *E. elutella* Hb. were killed by a concentration of 12·5 gm. per cub. m. applied for twenty-four hours.

Calandra granaria L., the corn weevil, was killed by a concentration of 18·75 gm. per cub. m. applied for twenty-four hours at 18° C. The insects are not dead immediately after fumigation, but methallyl chloride proved to have a strong after-effect, so that within a few days all the insects are killed. Eggs, larvæ and pupæ are also killed. Imagines of *Calandra*, placed in the centre of a bag of wheat, were easily reached and killed by the gas.

It is surprising that if the fumigation time is reduced to one eighth (from twenty-four hours to three hours) only a four times higher dose is required, which is not in keeping with Haber's law ($c \times t = K$).

Five kgm. of methallyl chloride was evaporated, by pouring it on to flat dishes, in a gas chamber of 70 cub. m. capacity, containing bags of wheat and maize with *Calandra* species, bags of peas with *Endrosis lactella* Schiff., cases of currants and apricot stones with *Ephestia elutella* Hb. and *Paralipsa gularis* Z., and also bags of cow hair with *Lermestes* species. At the end of twenty-four hours the gas was drawn off by suction. All the insects were killed. The temperature was 20° C.

A cocoa storage loft of about 150 cub. m., infested by tens of thousands of larvæ of *Ephestia elutella*, the cocoa moth, was treated in the same way at a temperature of 14° C. All the larvæ were exterminated.

In these tests, special attention was paid both to the influence of the gas upon the smell and taste of the gassed products and its toxicity to mammals.

As a soil insecticide, methallyl chloride was also used. Larvæ of the cockchafer were killed by a dose of 25 gm. per sq. m. distributed in four holes.

The great majority of plants are not damaged by methallyl chloride.

A detailed publication on methallyl chloride is being prepared and will be issued shortly.

C. J. BRIEJÈR.

Laboratory,
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May 17.

[1] U.S. Dept. Agric. Bull. No. 1313.

Pterinopecten papyraceus and "*Strophomena*" *pecten*

LINNÆUS, in the tenth edition of "Systema Naturæ" 1758, p. 702, described a species *Anomia pecten* in these words: "A. testa semi-orbiculata depressa multistriata; valvula altera plana (List. angl. 243, t. 9, f. 49). Testa inferne ſ. margine cardinis linea recta ſ. transversa". No locality was given, but a specimen is contained in his cabinet at the Linnean Society, London.

Lister's figure, cited by Linnæus, is of a specimen "ex fodinis carbonum Fossilium juxta Hallifax", and is quite recognizable as *Pterinopecten papyraceus* (J. Sowerby, 1822) known to occur in the Halifax Hard marine band of the Coal Measures. The above description could be held to apply to this shell. By a strict application of the rules of nomenclature, J. Sowerby's specific name would appear to be invalidated by Linnæus's previously erected species.

On the other hand, there is no doubt that Linnæus had before him Swedish Silurian brachiopod shells long known as "*Strophomena*" *pecten* Linn. Knowledge of the typical form was spread by personal contact among the Swedish palæontologists, and the first figured specimen of '*S.*' *pecten*[1] is probably conspecific with the specimen still preserved in the Linnean cabinet.

This confusion seems to arise from a difference of method. Linnæus presumably only intended to show the general appearance of his shell to other workers, not to establish a type specimen.

Since *Pterinopecten papyraceus* is a common shell, cited in European literature for more than a hundred years, strict interpretation of the rules would lead to confusion. Therefore I am applying to the International Committee for Zoological Nomenclature for a suspension of the rules in this case, so that the specific name *pecten* Linn. can be retained for the Silurian brachiopod.

Other of the Linnean species are similarly referred to figures which do not represent the species in the modern interpretation, for example, such a common fossil as *Atrypa reticularis*, and if the rules are suspended in this case, a precedent will have been set up for the retention of those Linnean species at present doubtful.

If the rules are suspended, and '*S*'. *pecten* Linn. is retained, I propose to figure and describe the specimen of '*Anomia*' *pecten* in the Linnean cabinet as the neotype.

ALAN WOOD.

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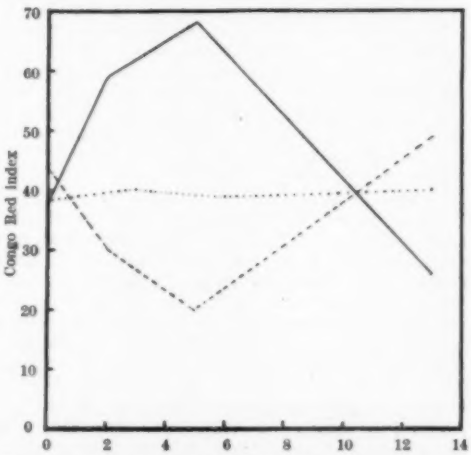
May 13.

[1] Dalman, Kogl. Vet. Akad. Handl. for 1827, 110 (1828).

Restropic Activity of Blood

WE have previously described the extraction from the anterior pituitary of two substances that affect the activity of the reticulo-endothelial system[1,2,3]. One (negative restropic factor) lowers the functional level of the reticulo-endothelial system, the other raises it (positive factor). We have now found that fresh blood (from rabbit or horse) also contains a positive restropic substance. It can be prepared by the methods already applied to extraction of anterior pituitary[3]. We have not yet found any difference, chemical or biological, between positive restropic extracts from blood and pituitary respectively.



ACTIVITY OF THE RETICULO-ENDOTHELIAL SYSTEM. BLOOD EXTRACTS FROM NORMAL SUBJECT (FULL LINE), CASE OF MALIGNANT DISEASE (BROKEN LINE), AND CASE OF CHOLELITHIASIS (DOTTED LINE).

The experiments have been extended to human blood. Samples of venous blood were obtained from healthy subjects and from various clinical cases. Each sample (5·0 ml.) was immediately extracted by a method previously described[3], deproteinization

followed by aqueous extraction of the precipitate. The extract, made up to a volume of 5·0 ml., was injected into a rabbit in daily doses of 1·0 ml. The Congo Red index was again taken as measure of the activity of the reticulo-endothelial system[4]. This index was determined before, and 24 or 48 hours after, the first injection; further determinations were made one day and about ten days after the last injection.

The resulting curves of the activity of the reticulo-endothelial system varied greatly (see accompanying graph). All healthy subjects yielded extracts that rapidly increased the rate at which the dye disappeared from the blood. This rise in the Congo Red index was followed, on cessation of the injections, by a return to the initial level. Normal human blood thus contains a positive restropic factor.

The blood of patients exhibiting various clinical conditions (other than malignant disease) yielded either positive or inactive extracts. Entirely different results were obtained with extracts of blood from cases of malignant disease. Such extracts rapidly lowered the index. This negative restropic effect is usually noticeable 24 hours after the first injection, but may take several days for its full development. Exceptions were noticed in two cases, one showing a tumour of the parotis, the other diagnosed as carcinoma of the ear; these extracts were inactive. No case of malignant disease so far examined has yielded positive extracts; no case of non-malignant disease so far examined has yielded negative extracts.

It would thus appear that human blood contains substances affecting the active mesenchyme in the manner previously described for pituitary extracts. The concentration and the nature of the restropic substances seem to be related to the condition of the subject. The positive restropic activity of the blood of healthy subjects may be absent in some clinical conditions, as yet undefined; in malignant disease it tends to be reversed. There is as yet no evidence to show whether the absence of positive restropic, and the presence of negative restropic, factors in cases of malignant disease have a causative or merely a symptomatic significance.

The samples examined were obtained, together with the clinical diagnosis, through the courtesy of Dr. P. O. Ellison, pathologist to the Royal Northern Hospital, the staff of the Royal Cancer Hospital (Free), Dr. J. Patterson, pathologist to the Charing Cross Hospital and Dr. Rouillard of the Waterloo Hospital.

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[1] Wetzler-Ligeti, C., and Wiesner, B. P., NATURE, **140**, 892 (1937).
[2] Wetzler-Ligeti, C., and Wiesner, B. P., *Chem. and Ind., Proc. Biochem. Soc.*, **57**, 85 (Jan. 22, 1938).
[3] Wetzler-Ligeti, C., and Wiesner, B. P., *Endocrinology*, **22**, 693 (1938).
[4] Stern, K., and Wilhelm, R., *Z. Exper. Med.*, **97**, 354 (1935).

Cytochrome Oxidase

IN a recent paper on the indophenol oxidase, now known as the cytochrome oxidase, Keilin and Hartree[1] repeat the statement which they made in an earlier paper[2] that "According to Harrison[3], it is hardly necessary even to postulate the existence of an enzyme such as indophenol oxidase. The oxidation of *p*-phenylenediamine in muscle preparation he explains as a secondary or coupled oxidation by means of a peroxidase or a hæmatin compound acting in conjunction with H_2O_2 formed in a primary oxidation of substances such as glutathione or hypoxanthine". They then proceed to give arguments against this secondary oxidation theory, but the facts they quote merely show that the indophenol reaction of tissues is not *solely* due to secondary oxidation.

I was well aware of these considerations, but showed in a number of ways that the indophenol oxidase theory alone does not explain all the experimental facts relating to the indophenol reaction; for example, the production of a positive reaction on adding hypoxanthine to liver suspension, even in presence of cyanide, which is known to inhibit the activity of the indophenol oxidase. What I actually said in concluding my paper was: "I feel that the explanation of the indophenol reaction and its significance in cell oxidations is best accounted for by assuming a combined action of an indophenol oxidase, as suggested by Keilin, and the secondary oxidation mechanism suggested in this paper. These together afford a satisfactory explanation of the observed facts."

So far from not believing in the existence of an indophenol or cytochrome oxidase, I carried out experiments shortly afterwards to show the interaction of a dehydrogenase system (glucose dehydrogenase) with the cytochrome-oxidase system as postulated by Keilin. These experiments gave a positive result[4] and have recently been confirmed in this laboratory.

The amount of secondary oxidation by hydrogen peroxide occurring in the intact tissues is at present unknown, but there is no reason to believe that it is negligible; indeed Keilin and Hartree[2] have themselves recently extended the number of systems which are known to be capable of bringing about secondary oxidations.

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Belfast.
May 25.

[1] Keilin, D., and Hartree, E. F., *Proc. Roy. Soc.*, B, **125**, 171 (1938).
[2] Keilin, D., and Hartree, E. F., *Proc. Roy. Soc.*, B, **119**, 114 (1936).
[3] Harrison, D. C., *Biochem. J.*, **23**, 982 (1929).
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Dismissals of Scientists in Austria

BRITISH and other scientists will be interested to know the position of some of their colleagues in Austria since the recent annexation of that country. It is difficult to get reliable information, as the dismissals, arrests and other measures of repression are not officially published, and the state of affairs in the Austrian universities and technical schools changes from day to day. Nevertheless, it is possible to give a preliminary and incomplete account of what has been happening in the field of the natural sciences. It should be borne in mind that the state of affairs in other fields is likely to be worse, since the natural sciences do not touch on political questions, while philosophy, history, sociology, etc., do.

The following is a list of professors of the natural sciences who have been dismissed (lecturers and assistant professors are not included):

Prof. Emil Abel, physico-chemist, Technical High School of Vienna.

Prof. Benndorf, physicist, University of Graz.
Prof. Felix Ehrenhaft, physicist, University of Graz.
Prof. Fritz Feigl, analytical chemist, University of Vienna.
Prof. Fuerth, physiological chemist, University of Vienna.
Prof. Philipp Gross, physico-chemist, University of Vienna.
Prof. Victor Hess, physicist, University of Graz (Nobel Prize winner).
Prof. Mark, physico-chemist, University of Vienna.
Prof. Stephan Meyer, director of the Radium Institute of the Academy of Sciences, Vienna.
Prof. Pauli, colloidal chemist, University of Vienna.
Prof. Karl Przibram, physicist, University of Vienna.
Prof. Hans Thirring, theoretical physicist, University of Vienna.
Prof. Otto Redlich, physico-chemist, Technical High School of Vienna.

Among the arrested are:

Prof. Baule, mathematician, University of Graz.
Prof. Karl Buehler, psychologist, University of Vienna (since released).
Prof. Dobretsberger, rector of the University of Graz.
Prof. Loewi, physiological chemist and pharmacologist, University of Graz (Nobel prize winner).

The following professors have been dismissed from the famous medical school of Vienna:

Drs. Julius Bauer, Richard Bauer, Bustin, Elias, Erlacher, Leopold Freund, Froschels, Glaessner, Glas, Gottlieb, Julius Hass, Walter Hausmann, Hammerschlag, Leo Hess, Oskar Hirsch, Hecht, Lieben, Ernst Lowenstein, Marburg, Henrich Neumann, Moriz Oppenheim, Pappenheim, Paschkis, Ernst Pick, Pollak, Porges, Ranzi, August Reuss, Sauser, Schilder, Schueller, Schur, Gottwald Schwarz, Max Sgalitzer, Scheminzky, Sicher, Silberstein, Stern, Stransky, Robert Stein, Weninger, Willheim, Emil Zak, Walter Zweig. Dr. Bruecke, of Innsbruck, has also been dismissed.

Among the physicians:

Prof. Ferdinand Blumenthal, the German authority on cancer, who was living in Vienna, is in prison; Prof. Oskar Frankel, the gynæcologist and histologist, and Prof. Knoepfelmacher, the well-known specialist in children's diseases, have committed suicide.

It must be pointed out that these measures have been directed against men of varying political convictions, and have hit those who were active in the Christian movement and those who were simply opposed to official Nazi principles, as well as democrats, socialists and Jews.

MARGARET GARDINER.
(Hon. Secretary.)
For Intellectual Liberty,
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June 3.

Darwin Misunderstood

To argue fully Sir Edward Poulton's two main points[1] against my biography—the "fragmentary" nature of Darwin and his "fear" of his father—would take more space than I can ask for. I will only remark on the first point that the term "fragmentary" was intended by me to refer primarily to categories of imaginative and intellectual activity, and that my case is not even touched by the fact that Darwin was, as everyone knows, the best of neighbours and friends; and on the second point that no more is Darwin's alleged "fear" of Robert Darwin disproved by citing his "boundless and most touching reverence," since—as any psychologist might testify—it is the very "boundlessness" of that reverence which suggests some hidden and contradictory motivation, lying in all probability, I would hazard, below the threshold even of Charles Darwin's own consciousness.

I stand by both these points (though admitting that the second can be of its nature only speculative), but I will readily confess that in relation to the first some of my statements were either too bold or too bald—sometimes both—and have been amended in the American edition published last month by the Yale University Press, where the sub-title "The Fragmentary Man" has been retired from the title-page to its proper place—the final chapter which I myself would prefer to regard as a personal comment upon, rather than integral part of, my biography. To make my point of view—which is one of the highest admiration for Darwin as man *and* as scientist—rather clearer, I should like to quote a few lines which appear in my American but not English preface to the book: "If I would attack anything, it is neither Darwin nor even Darwinism but dogmatism, above all that dogmatism which regards its own particular truth—whether scientific, artistic, or religious—as final. Like Emerson, I do not believe in final truths, nor do I regard it as a derogation of a great man to indicate that he, like every other natural creature, had his limitations. On the contrary, I would contend that greatness only yields its full harvest when its limitation is completely understood."

I should also like to stress the fact that my book is primarily a biography—in nineteen, indeed, out of twenty chapters—and not only of Charles Darwin but also of his grandfather Erasmus, and of the immediate Darwin and Wedgwood families from 1730 to 1896.

GEOFFREY WEST.
22 Lathbury Road,
Oxford.

[1] NATURE, 141, 807 (May 7, 1938).

THOSE who have read the words quoted from Mr. Geoffrey West's book will have formed their own opinions upon the fairness of my comments. I feel sure that they will be glad to learn the intentions of the author and also to know that the word "fragmentary" is not prominent in the American edition.

EDWARD B. POULTON.
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Oxford.

Convergent Sunbeams

I CAN add to the correspondence on the above subject in NATURE of February 19 and March 26 by reporting that I have observed the phenomenon on numerous occasions at Diyatalawa, a village at an altitude of 4,000 ft. on the eastern side of the central hills of Ceylon. The western horizon about eight miles away is the edge of a block of rough mountainous country with many peaks of about 7,000 ft. altitude (including the well-known Adam's Peak). During the clear weather of spring and summer, I frequently observed the shadows converging on the eastern horizon at sunset, and I used to wonder if they could be produced by prominent peaks as well as by clouds.

J. E. JACKSON.
Survey Office,
Badulla, Ceylon.
April 24.

Preparation of Radio-Element $^{32}_{15}P$ by Means of an Electric Field

I WISH to correct slightly my recent letter in NATURE[1] on this subject. The number of neutrons emitted by a radium plus beryllium neutron source has been accurately measured (C. J. Bakker[2] and other observers) and found to be $(2{\cdot}1 \pm 0{\cdot}2) \times 10^4$ neutrons per sec. per mC. radium. The source of 120 mgm. used in our experiments emitted during nine days about $1{\cdot}96 \times 10^{12}$ neutrons. If each neutron transformed an atom of sulphur into radio-phosphorus (ideal case certainly not realized) we should obtain $1{\cdot}96 \times 10^{12}$ atoms of $^{32}_{15}P$ weighing about 10^{-10} gm. Hence the coloration and the increase in weight of 3·7 mgm. of the electrode in our experiment cannot be due to the radio-phosphorus.

Nevertheless, as is shown by our experiments on the photographic action of the electrodes[3] and the measurements with the Geiger-Müller counter, practically all the activity is collected on the electrodes.

Spectroscopic and chemical experiments are proceeding in order to determine the cause of the coloration and increase of weight of the electrodes.

Note added in Proof. After sending the above correcting letter, Prof. F. A. Paneth (London), M. Goldsmith (Paris) and Dr. J. Tandberg (Stockholm) wrote pointing out that, in connexion with the number of kicks per minute observed, we obtain a quantity of radio-phosphorus weighing less than 10^{-11} gm. I had myself made a similar calculation, but have not mentioned it above in order not to occupy further space needlessly.

J. GOVAERTS.

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May 20.

[1] Govaerts, J., NATURE, 141, 871 (1938).
[2] Bakker, C. J., *Physica*, 4, 723 (1937).
[3] Groven, Ch., Govaerts, J., Guében, G., NATURE, 141, 916 (1938).

Points from Foregoing Letters

New values for the 'packing fraction' of atoms of titanium (mass 48), chromium (mass 52), nickel (mass 58) and bromine (mass 79 and 81) are given by Dr. F. W. Aston, as calculated from mass spectrographic measurements on doublets (electrically charged atoms and groups of atoms having the same mass/charge ratio). A knowledge of the packing fraction is necessary in calculating energy changes involved in atomic transmutations.

Clarifying and commenting on some of the statements on resonance and nuclear photo-effects, dealt with in a previous note, Prof. N. Bohr points out that in the case of strictly monochromatic radiation one cannot separate the initial excitation of a certain mode of oscillation from its subsequent quenching due to coupling; also the selectivity is independent of the ratio between the chances of the re-emission of the whole energy as a single radiation quantum in the initial and in the subsequent stage of the excitation process.

A temperature gradient in liquid mercury has been shown to give an electromotive force, the current flowing in the external circuit from the hot to the cold side (first "Benedicks effect"). Further experiments by Prof. C. Benedicks and P. Sederholm show that when the mercury is purified and freed from gas the E.M.F. changes sign. The author suggests that the known anomalous behaviour of mercury, which gives a negative sign for the Thomson effect, might also disappear if suitably purified mercury were used.

By injecting labelled radioactive sodium phosphate into frogs and afterwards determining how much of the labelled phosphorus is combined as creatine phosphoric acid, Prof. G. Hevesy and O. Rebbe find that, in the course of a day, practically all molecules of creatine phosphoric acid in the muscle are broken up and 'rejuvenated'. The phosphatide molecules in the blood of the dog, on the other hand, were found to take up only a small amount of labelled phosphorus during 24 hours, indicating a low rate of rejuvenation.

Messrs. Craxford and Gatty and Lord Rothschild discuss the theory of adsorption potentials and some recent work of Ehrensvärd and Sillén on this subject. From the results obtained by the latter, the authors conclude that the early stages of a diffusion gradient in oil-water interphases may confine the diffusion to the first one or two molecular layers of the oil phase.

D. F. Cheesman, A. King and Dr. J. N. Sugden report that certain inorganic salts, such as potassium iodide, while increasing the interfacial tension, have the property of stabilizing the emulsion of water in amyl alcohol.

Tests have been carried out by C. J. Briejèr to determine the insecticidal effect of methallyl chloride in a gaseous condition. This material proved to be efficacious for combating insects both in stores and in the soil.

Dr. A. Wood is applying to the International Committee for Zoological Nomenclature for a suspension of the priority rules, which would enable the specific name *pecten* Linn. to be retained for the Silurian brachiopod which Linnæus probably had before him, rather than it should be applied to *Pterinopecten papyraceus* from the coal measures, which was figured by Lister and cited by Linnæus.

The blood of the rabbit, horse, and also of normal human beings, is found by C. Wetzler-Ligeti and Dr. B. P. Wiesner to contain a positive 'restropic' substance, that is, to increase the activity of the reticulo-endothelial system, as measured by the 'Congo-red index'. The blood of human patients suffering from cancer was found to be either inactive or more generally to have a lower Congo-red index.

Prof. D. C. Harrison states that while he does not doubt the existence of the enzyme 'indophenol oxidase' (also known as cytochrome oxidase), as postulated by Keilin and Hartree, this alone does not explain all the experimental facts observed; for example, the production of a positive indophenol reaction on adding hypoxanthine to liver suspension in the presence of cyanide, which inhibits the activity of the indophenol oxidase. To explain satisfactorily the indophenol reaction of the cell oxidations Harrison postulates an additional secondary oxidation by hydrogen peroxide, of a similar mechanism.

Research Items

Ancient Pottery from Peru

A SERIES of ancient Peruvian vases presented to the Department of Ethnography of the British Museum (Bloomsbury) by the Christy Trustees has been described and figured by Mr. H. J. Braunholtz (*British Museum Quarterly*, **12**, 2, 1938). Some examples are without parallel in any other collection. Of the thirty-seven vases, thirty-one unmistakably belong to the Nasca region of the southern Peruvian coast. The remaining six are of Early Chimu and Chimu types from northern Peru. It is still impossible to assign any more precise dating to the Nasca or proto-Nasca ware than the first half of the first millennium A.D.; but as a result of a detailed analysis by Kroeber, this ware has been divided into three groups, forming a chronological sequence, A and B with an intervening X. By this definition the figure vases with modelled heads in the British Museum series fall into group B, while the flaring bowls, though having A shapes, are also to be assigned to group B on account of their painted designs. The 'jagged staff demon', a mythological figure, is characteristic of the B group, and a progressive subordination of realism to decorative purposes is shown in the suppression of the body and the disconnected treatment of the legs. Figure vases representing women have variations of the 'jagged staff demon' painted on their cloaks at the back. Modelled figures, especially animals and birds, from Nasca are rare. Some interesting points are raised by those in this series. The style and colour justify their inclusion in Early Nasca, but a double-bodied figure representing an owl is typical rather of northern Peru, where such figures belong to the Late Chimu period, considerably later than Early Nasca. This specimen has a further affinity with Chimu in being a whistling vase. Another vase in the form of a snake or eel-like creature is also of the whistling type.

Decorative Art of the Australian Aborigines

DR. DANIEL SUTHERLAND DAVIDSON, assistant professor of anthropology in the University of Pennsylvania, under a fellowship grant of the Science Research Council of New York, has made a study of the decorative art of the aborigines of Australia, based upon an examination of material in the Australian museums, and on field work in north Australia (*Mem. Am. Phil. Soc.*, **9**; 1937). This study is to be regarded as preliminary, in view of the absence of information from certain specific localities and the difficulty of securing painted, as opposed to incised, objects. Aboriginal paint is impermanent, and certain classes of painted objects are always burnt at the close of the ceremonies in which they are used. Only objects of major regional or continental significance have been considered. The aborigines gave considerable attention to the decoration of their possessions, utilitarian and sacred. Much Australian art is primarily æsthetic, but much also of profound religious significance. Designs are usually applied by incising or painting. Other techniques are employed, but little is known of this subject, or of symbolism and design analysis. Many of the designs are of local distribution. Others are scattered all over the continent. Although the psychological incentives are more or less constant, the expression in design and technique varies according to historic influences. The continent basically seems to be an art unit, historically considered. Available evidence in respect of contemporary art indicates that Australia can be divided into five roughly determined and overlapping design areas, each divisible into sub-areas. These areas have permanent characters; but changes in design and styles of portrayal are currently taking place as the result of diffusion and local elaborations.

Cerebro-spinal Fluid

THE content of a series of lectures on the meninges and the cerebro-spinal fluid delivered at University College, London, has recently been given by Prof. L. H. Weed (*J. Anat.*, January 1938). The article furnishes an interesting account of the history of the discoveries and theories relating to this subject from as far back as Alexander Monro, 1783, up to the present day, when a considerable amount of research on it is being carried out in the author's laboratories. It is now established fairly satisfactorily that the cerebro-spinal fluid is secreted by the choroid plexuses and thence passed into the neural cavities. The excess passes from the 4th ventricle into the subarachnoid space and thence, via the arachnoid papillæ, directly into the venous system. The cerebro-spinal cavity is regarded as a closed system which protects its contents from changes in atmospheric pressure. When man's precursors adopted an upright posture, it naturally affected the pressures in the column of fluid in the cerebro-spinal cavity, and apparently no protective mechanism has been developed to meet this. It is not so serious a problem as might be expected since, as the author shows, the closed cerebro-spinal system has a morphological and physiological mechanism whereby the volume of the brain can vary, the volume of the blood can vary, the volume of the cerebro-spinal fluid can vary, but the total volume of the whole contents of the system can remain relatively constant.

Genotypic Selection for Weight in Mice

AN interesting experiment in selection for increased size in the albino mouse is described by Dr. H. D. Goodale (*J. Heredity*, **29**, No. 3). He used the method of genotypic rather than phenotypic selection, that is, selection by progeny test. The experiment began in 1930 with 4 males and 8 females, a similar number being added the following year. The thousandth male was born three years later, and all descendants since that date, January 1934, are derived from 16 mice. The males at first averaged 26 grams and the females 21·3 grams. Matings were made only on the basis of weight at two months after birth and without regard to relationship or age; so the generations overlap, ranging from 12 to 16 for the whole experiment to date. The mean weight shows a steady increase, the last 500 males averaging 36·4 grams, an increase of 40 per cent. The present average weight exceeds by several grams the maximum weight of mice in the early generations. It is suggested that the present results indicate the presence of at least 32 pairs of genes affecting weight. The results can be explained in terms of the multiple

factor hypothesis; but there is no indication that the limits of size are being approached, or of the number of genes affecting size which may be present. The results are not attributed to the occurrence of size mutations during the experiment, but to the method of selection adopted.

Metabolism in Lepidoptera

MR. I. W. KOZHAUTSHIKOV, of the Zoological Institute, Academy of Sciences, Leningrad, has recently published an article on the above subject (*Bull. Entomol. Res.*, March 1938). It is concerned with carbohydrate and fat metabolism in certain moths, namely, the common species *Agrotis segetum*, *Pyrausta nubilialis* and *Loxostege sticticalis*. Moths reared from caterpillars, bred under optimal conditions, were used in these experiments just after they had emerged. It appears that fat synthesis is of great importance in the metabolism for the maintenance of the body weight with the same supply of energy and for egg-yolk production. Moths increase their live weight by the consumption of sugar solution often by 40–50 per cent, but the fat synthesis out of sugar, and the water output, rapidly reduce the live weight to normal. Changes in the respiratory quotient show a peculiar metabolic phase after carbohydrate nutrition due to fat synthesis. The fat synthesis of carbohydrates results in a decrease in oxygen consumption for the reason that the oxygen liberated by the fat synthesis reaction is utilized. The author recognizes two types of specialization of carbohydrate metabolism as being present in adult insects. He quotes Beutler (1936) as showing that in bees, sugar is used directly without transformation into fat, and no reserves of fat have been observed in these insects. The reserves of sugar are found in the stomach, and the activity of the insect is only possible so long as these reserves are not used up, feeding being necessary many times a day. In Lepidoptera, on the other hand, a large quantity of sugar can be taken during a short period and utilized after its transformation into fat. Feeding is not necessary every day for some species, and they can live for their normal period, even if food is taken only once during the first few days of adult life.

Agaricaceæ of Hokkaido, Japan

AN extensive, detailed survey of the agaricaceous fungi which occur in Hokkaido, Japan, has recently been published by Sanshi Imai (*J. Fac. Agric. Hokkaido Imp. Univ.*, **43**, Pt. 1, 1–178, with 3 plates, March 1938). Studies were commenced in 1924, and now twenty new varieties are described, many of them for the first time. A modified classification is used, which accommodates the Japanese species without rupturing well-established groups. New tribes and subgenera are established with Latin diagnoses, whilst the descriptions of species are detailed, and in English. The volume is critical and contains adequate references; it provides a fitting superstructure to the modest mycological foundations first laid in Japan in 1860 by two British investigators, M. J. Berkeley and M. A. Curtis. Thirty-two excellent half-tone illustrations, combined into the three plates, include many of the new species, and also show a few kinds which are common in England. The general impression of the present volume, however, is that of a special flora, typical of Japan, and having but little in common with other fungus floras of regions in the same latitude.

Crystalline Preparations of Potato Virus *X*

THE virus of tobacco mosaic has been isolated as a crystalline nucleo-protein of high molecular weight. This particular virus has, however, many properties different from other viruses, and it did not appear safe to assume that the others would have similar composition. Messrs. F. C. Bawden and N. W. Pirie have recently shown (*Brit. J. Exp. Path.*, **19**, 66–82, 1938) that the *S* and *G* strains of potato virus *X*, isolated from infected tomato, tobacco or *Nicotiana glutinosa* plants, do indeed yield nucleo-proteins, which can be prepared as liquid crystalline extracts. No such preparations could be isolated from healthy plants, and all available evidence suggests that they are the viruses themselves. Concentrated solutions were spontaneously birefringent, and dilute solutions exhibited anisotropy of flow, as was established for tobacco mosaic virus. Filterability and various types of inactivation were described for both viruses. Potato virus *X* is perhaps more typical of viruses in general than tobacco mosaic, so it seems more probable that all viruses may be specialized nucleo-proteins.

Desiccation in West Africa

THE problem of progressive desiccation in the western Sudan between the Sahara and the humid belt has received much attention in recent years. Prof. E. P. Stebbing recently developed a theory of the steady encroachment of the Sahara on Nigeria and the replacement of the natural vegetation by drier types. The problem has lately been investigated by an Anglo-French Forestry Commission in northern Nigeria and the French Niger colony. In an article in the *Geographical Journal* of May, Mr. Brynmor Jones reviews the evidence especially as regards northern Nigeria and reaches somewhat different conclusions from those of Prof. Stebbing. Silting up of streams and river capture have reduced the amount of surface water on the fringe of the Sahara, but this process is very slow and does not contribute an immediate threat to the prosperity of the West African colonies. It can, moreover, be delayed by protection of head waters and by flood control. Protection of forests in certain places in order to check erosion is advisable, and the practice of shifting agriculture is certainly harmful in the drier parts in accelerating erosion. But Mr. Jones finds little evidence that depopulation is due to desiccation. He attributes it rather to political and economic factors, inter-tribal wars, slave raiding and pestilence. He is guarded on the problem of climatic changes. These have no doubt occurred since the Quaternary period, but changes are too slow to be noticeable in the space of a few hundred years. Minor oscillations are characterized by cycles of years of relatively high or relatively low rainfall. The last major change appears to have been one towards more humid conditions.

Volcanic History of Montserrat

EARLY in 1936 the Royal Society, in collaboration with the Colonial Office, organized an expedition to Montserrat, with the object of studying the geology of the island and of investigating earthquakes and soufrière activity that had caused considerable damage and alarm in the two previous years. A. G. MacGregor, the geologist of the expedition, has now published the results of his investigations (*Phil. Trans. Roy. Soc.*, B, **229**, 1–90; 1938). An outline of the geological history and structure of the island and an account of the active soufrières is followed by

a detailed petrological study of the rocks. The latter are mainly labradorite-dacites and olivine-basalts, but nevertheless they represent almost the full range of types known in the Caribbean volcanic arc. The chemical characters are brought out with the aid of seven new analyses, and it is shown that there are many analogies with the Lassen Peak district of California. Special attention is devoted to cognate xenoliths and dome formation; magmatic corrosion of feldspar phenocrysts; oxidation and resorption of hornblende; origin of breadcrust bombs of the peléan type; and the occurrence of tridymite and cristolabite. It is pointed out that prediction in regard to future events in the Lesser Antilles is made difficult by the lack of continuous scientific records of past soufrière activity and earthquakes. Since 1692, the longest period that has elapsed without volcanic disturbance somewhere in the arc is 47 years, but on seven occasions the interval of tranquillity has been seven years or less. There is thus every reason to believe that eruptions or earthquakes will be renewed in the arc at no very distant date, and probably more than once in the lifetime of the present generation.

Methylene

THE methylene radical, CH_2, has often been invoked as an intermediate in combustion reactions, the thermal decomposition of hydrocarbons, and other processes. The first direct evidence of its existence was obtained in photochemical investigations on the decomposition of keten: $CH_2 : CO = CH_2 + CO$. T. G. Pearson, R. H. Purcell and G. S. Saigh (*J. Chem. Soc.*, 409; 1938) now describe the formation of methylene from keten and diazomethane ($CH_2{:}N_2 = CH_2 + N_2$) by thermal and photochemical decomposition. Keten is not easily decomposed thermally to give methylene but readily does so when exposed to light of 2580–3130 A. Diazomethane is thermally decomposed to produce methylene. The apparent life of the methylene was different when produced from keten and diazomethane, being very long in the first case and similar to that of an alkyl radical in the second. The methylene was detected by reaction with selenium and tellurium. The authors describe a large amount of experimental work and they consider that their results show that free methylene should be regarded as a highly reactive molecule rather than a free radical in the sense that methyl is. Its persistence is therefore a function of its environment, as indicated by the varying life when obtained from different materials. A consequence of this point of view is that the carbon atom in methylene is essentially bivalent, or in a ^1P state, as postulated by Nef and others and recently emphasized by Norrish and collaborators.

The *p*H Scale

IT is customary to determine *p*H values by means of the equation (1): $pH = (E - E_0)/2{\cdot}3026(RT/F)$, where E is the potential of the cell: (Pt), H_2 : solution X : KCl sat. : reference electrode (A), and where E_0 is a constant at a given temperature, depending on the nature of the reference electrode. It is also customary to interpret *p*H according to the equation: $pH = -\log a_{H+}$, where a_{H+} is the hydrogen ion activity. This procedure is based on the belief that the liquid junction potential at the boundary between solution and saturated KCl solution is very small or constant. D. A. MacInnes, D. Belcher and T. Shedlovsky (*J. Amer. Chem. Soc.*, 60, 1094; 1938) direct attention to certain difficulties in this procedure, and propose another method of calculation in which the equation (1) is retained, but they adjust the thermodynamic quantities as closely as possible by means of a shift of E_0 from the value commonly used. For this purpose, buffer solutions were used as solution X. If C_{HA} and $C_{A'}$ are the concentrations of weak acid and its anion in the buffer solution, they find that $pK' = pH - \log (C_{A'}/C_{HA})$ has, up to an ionic strength $\mu = 0{\cdot}01$ mol./lit., an empirical value $pK' = pK_0 - B\sqrt{\mu}$, where pK_0 and B are constants. The value of E_0 is then adjusted so that the equations yield a value of pK_0 equal to the thermodynamic constant pK. The *p*H values of commonly used acetate and phthalate buffers were so redetermined at three temperatures. The authors point out that the uncertainties in the liquid contact potentials and the theoretical impossibility of finding single ion activities lie at the root of the present difficulties in setting up a *p*H scale.

Visible Radiation of Electrons in Pure Liquids

P. A. CHERENKOV (*Bull. Acad. Sci. U.R.S.S.*, 491; 1937) finds that when fast electrons (β-rays or Compton electrons) pass through pure liquids they cause a faint visible radiation showing unusual properties. The spectrum is continuous and extends into the far ultra-violet; the energy distribution shows an increase to shorter wave-lengths. The most characteristic feature of the radiation is its asymmetrical distribution in angle around the path of the electron. According to a theory developed by I. M. Frank and I. F. Tamm, the radiation is due to the velocity of the electrons in the medium being greater than the phase velocity of light in the medium.

Markings on a Satellite of Jupiter

UNDER the title "Markings of the Third Satellite of Jupiter in Transit across the Planet", a paper by Dr. E. M. Antoniadi has recently appeared (*J. Brit. Astro. Assoc.*, **48**, 7; May 1938). At the end there are several notes by Mr. B. M. Peek, director of the Jupiter section, in which he refers to the work of other noted observers, more especially members of the British Astronomical Association. Dr. Antoniadi has produced some very beautiful drawings showing the appearances presented by satellite iii in transit in 1927, and beside these he has placed drawings made by W. R. Dawes during transits in 1849, 1860 and 1867. The evidence that the satellite rotates in the same period that it requires to revolve around Jupiter can now be considered established. The author of the paper points out that although satellite iii is frequently represented as larger than satellite iv, this is not correct. Satellite iv is actually the largest of all such bodies in the solar system. Another interesting matter is referred to. Although the mass of the satellite is more than twice that of the moon, yet the velocity of escape is almost comparable from the gravitational point of view. But as the satellite receives considerably less heat than our moon, the velocity of the gaseous molecules is thereby lessened, and it is possible that the satellite may have a highly rarefied atmosphere of heavy gases. The apparent distortion of satellite iii, which has been noticed by many observers, presented a difficulty until 1921, when the Rev. T. E. R. Phillips showed that it was due to the spots of the satellite.

Hydrobiology and Fisheries Laboratory, Alexandria

IN a review that appeared in NATURE[1] of some publications of the Directorate of Hydrobiology and Fisheries, Egypt, F. S. Russell concludes thus: "Now that research is on so sound a footing, the Egyptian Government should see grounds for fostering and furthering investigations in this most interesting region". Dr. C. Crossland has already described in NATURE[2] the Marine Station of the Egyptian University at Hurghada on the Red Sea, and a short description of the Egyptian Government Laboratory on the Mediterranean at Alexandria may be of interest.

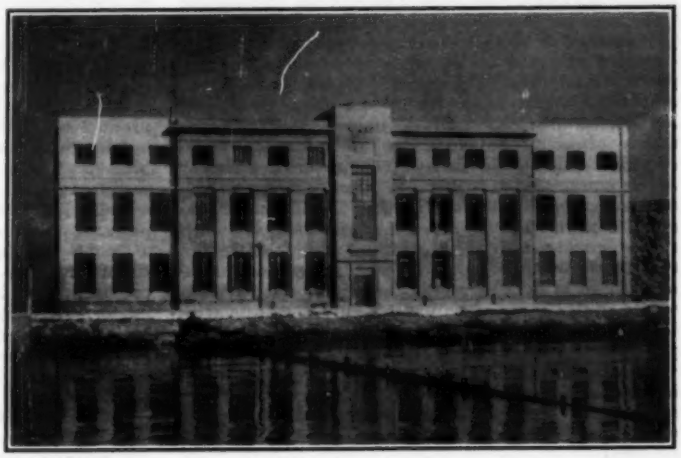
The favoured position of Egypt overlooking two seas, the incomplete knowledge we possess of the Eastern Mediterranean basin, and the existence of two main factors influencing that basin, namely, the opening of the Red Sea on the Mediterranean through the Suez Canal, and the Nile flood arriving at the coast by the end of summer, and throwing great quantities of freshwater into the Mediterranean—all these facts present problems of exceptional interest for research workers in aquatic biology.

The Cambridge Expedition to the Suez Canal[3] has already proposed to repeat its exploration after a lapse of only ten years. Workers at the Hydrobiology and Fisheries Laboratory have carried out some research round Alexandria, in which the effect of the Nile flood on the area is incidentally touched upon. In the Suez Canal, the regime of currents has been studied by monthly observations of salinity, oxygen content and temperature at nine stations on the Canal; and the movements of the phytoplankton have been examined at six stations. These studies must be continued in order to observe any changes produced by the Red Sea waters reaching the Mediterranean for at least nine months every year, and the Nile flood water breaking, between September and August, through the earth barrages artificially raised at the mouth of the delta every year in February.

The Laboratory at Alexandria offers facilities for visiting scientific workers to proceed with research on these lines, or in any other direction. A launch is attached to the Laboratory, for short coastal trips, and the research steamer *Mabahiss* can be used for more important cruising.

The laboratory is a three-storied building, situated on the tongue of land supposed to be the promontory of Pharos Island, on which stood the famous lighthouse of the Ptolemies. It overlooks, from the south-eastern side, the bay now known as the Eastern Harbour, and from the north-western side, the open sea. This situation unites the advantages of being right near the sea, and of being twenty minutes journey by bus or tramway from the centre of the town of Alexandria. Accommodation for living on the premises of the laboratory is thus rendered unnecessary.

The ground floor contains the show-aquarium, with twenty-four tanks, and sea or fresh-water *ad libitum*. There are four research cubicles, with sea and fresh-water laid on to taps, and possibility of establishing research aquaria when needed. The chemical store, a dark-room, bath-room, lavatories, and store-room for gear, etc., complete the ground-floor.



THE ALEXANDRIA MARINE LABORATORY.

There are seven research laboratories on the first floor; there are incubators, fume cupboard, electric centrifuge, accurate balance and refrigerator. The offices and the Director's laboratory complete this floor.

The library and the museum occupy the second floor.

On the roof is a cement tank for sea water, with pipes to the aquaria and the laboratories. Sea water is brought in to another cement tank at the basement of the laboratory by an 'eternite' (asbestos and cement combined) pipe laid for sixty metres in the water of the Eastern Harbour; water is drawn from this tank by electric pumps which either send the water to tanks under the ground floor, where it can be filtered, or directly to the roof-tank.

Applications for work and for more ample information, should be sent to the Director, Marine Laboratory, Kayed Bey, Alexandria.

HUSSEIN FAOUZI.

[1] NATURE, **137**, 1080 (June 27, 1936).
[2] NATURE, **134**, 743 (Nov. 10, 1934).
[3] *Trans. Zool. Soc.*, **22** (1924).

The London Television Service

A MEETING of the Institution of Electrical Engineers held on April 21 was devoted to a series of papers describing the development of the television broadcasting service which has been operated by the British Broadcasting Corporation at the Alexandra Palace station since August 1936. The first paper, by Messrs. T. C. Macnamara and D. C. Birkinshaw entitled "The London Television Service", recalled certain early electrical discoveries which laid the foundations of modern television. The Nipkow scanning disk was invented in 1884 and is still in use in certain systems to-day; while in 1908, A. A. Campbell Swinton described the forerunner of the present-day cathode ray tubes used both for scanning and for reproduction purposes.

In 1929, arrangements were made between the B.B.C. and Baird Television, Ltd., for the first regular transmissions from a London station of television programmes of the low-definition type, using 30-line scanning and 12½ pictures per second. Some five years later, His Majesty's Postmaster-General appointed a committee under the chairmanship of Lord Selsdon to review the development of television and to advise on the conditions under which a public service should be conducted. The recommendations of this committee were put into effect in August 1936, by the inauguration of the London Television Station at Alexandra Palace. After a trial period, in which the technical merits of two systems of high-definition television were compared, the same committee announced in February 1937 that the London station would in future use the Marconi–E.M.I. system with its interlaced scanning with 405 lines and 25 frames per second. The use of interlaced scanning is advantageous in that it has the apparent effect of increasing the picture-repetition frequency to 50 per second, at which no flicker is perceptible to the eye, without increasing the band of modulation frequencies required.

A detailed discussion of the development of this standard of scanning with a specification of the radiated wave-form employed is given in the second of the series of papers, entitled "The Transmitted Wave-form", by A. D. Blumlein. The transmission is of the so-called direct-current type in that there is no fixed average value of the carrier wave amplitude. Under normal running conditions, with no transmitted picture, the 'all-black' condition is represented by the carrier wave amplitude being at 30 per cent of its peak value, the line and frame synchronizing impulses reducing this to zero amplitude at the appropriate intervals. This arrangement of the conditions is claimed to minimize the effect of interference on the synchronism of the received picture. The 'all-white' condition is represented by full modulation at the peak amplitude, so that the vision signals occupy values between 30 per cent and 100 per cent of the radiated carrier. Details of the equipment which has been developed to handle the modulation which arises from this method of transmitting the picture signals are given in the third paper, entitled "Vision Input Equipment", by C. O. Browne. This paper includes a cursory description of the technical features of the equipment, and contains a list of references to more detailed information.

The fourth and last paper of the series was presented by Messrs. N. E. Davis and E. Green under the title "The Radio Transmitter". The vision transmitter at the London station was designed to give a peak output power of 17 kw. when a steady condition is maintained corresponding to the transmission of a full white picture. The general design of the transmitter was based on the fundamental principles which have now been in use for some years in commercial short-wave communication transmitters, but certain new problems were met in adapting this design to the ultra-short wave-length of 6·7 m. (frequency 45 Mc./sec.) required and also to enable it to handle the unusually great modulation bandwidth of ± 2·5 Mc./sec. The paper gives some details of the circuit, valves and assembly employed at the Alexandra Palace station.

Reverting to the first paper by Macnamara and Birkinshaw, considerable space is devoted to a general description of the London Television Station, with plans of the accommodation and details of the studios and equipment employed for the staging and production of the vision programmes radiated. For outside broadcasts, a fleet of special motor vans has been developed, these carrying respectively a mobile studio, an ultra-short wave transmitter for providing a radio link with Alexandra Palace, and a mobile power supply for the above two vehicles. In addition, a fourth vehicle is used to carry an extensible self-supporting wooden ladder of the fireman's type, to provide an aerial mast for the local mobile transmitter. Reception from this transmitter is carried out with a radio link receiver installed at Alexandra Palace, but precautions have had to be taken to secure freedom from interference from the main vision transmitter.

To avoid difficulties involved in the operation of such an ultra-short wave radio link, a balanced low-capacitance cable, primarily designed for television, has been installed between Alexandra Palace and central London, tapping points being provided at frequent intervals along the cable route at what may be considered to be the main points of interest from a television programme point of view. In addition, experiments have been conducted into the use of short lengths of ordinary telephone line whereby extensions may be made from the main television cable.

The latter portion of the paper gives the results of a field strength survey of the radiation from Alexandra Palace, and a contour map illustrates the distribution of the field at distances up to 25 miles from the station. This was the range originally estimated for, but it is now safe to say that good reception can be obtained up to about 35 miles, except in cases where unusually bad interference is encountered. Under exceptionally favourable conditions, good reception has been reported at distances of 40 to 60 miles, and while reception is still possible at much greater distances up to a few hundred miles, this usually does not come up to the standard of reliability which it is desirable to attain in a public broadcasting service.

Altogether these four papers form a useful and interesting record of the successful development and operation of what still remains the first public television service in the world. R. L. S.-R.

Association of Teachers in Technical Institutions

ANNUAL CONFERENCE AT LEEDS

THE twenty-ninth annual conference of the Association of Teachers in Technical Institutions was held in Leeds on June 4–7. A civic welcome was accorded to the delegates by the Deputy Lord Mayor of Leeds, who was supported by the Director of Education. The president for 1938–39, Mr. A. C. R. Ritchie (Gravesend), was inducted by the retiring president, Mr. W. E. Park (Luton). In his presidential address, Mr. Ritchie reiterated the Association's belief in the principle of collective security and said that in spite of the rapid deterioration in standards of international integrity, "we believe that it is not too late for the nations to get together in a sane and orderly atmosphere, so that they may work together for the common good of their people, and that the wonders of scientific discovery and inventive genius may at last be directed towards increasing human happiness instead of being prostituted to the destruction of modern civilization. After all," he asked, "what has civilization done for us if we cannot live peaceably one with another?"

In this connexion, Mr. Ritchie referred to a remark by the Chinese Ambassador during a recent address to an international conference of teachers convened by the League of Nations Union. Arguing that "We will have to scuttle back to the humanities to save our lives, let alone ourselves," the Ambassador said, "Technical Education is now ripening to make us cave-men as its final fruit." Mr. Ritchie hoped he would not be misunderstood if he reminded the Ambassador that such a statement is scarcely fair to technical education. No one more than he sympathized with the desperate sorrows of peoples torn by war. But technical education is not necessarily responsible for those sorrows. On the contrary, it gives us possibilities of life-standards hitherto unknown. Could the Conference which His Excellency addressed have been held without the aid of technical education? Here were representatives of many countries brought to London by all the modern forms of transport. Their words and thoughts were transmitted across space by means of inventions just as modern. Because social ideas move slowly, because a minority prostitutes the work of scientific workers and technologists, science and technology should not be blamed. If there are those who use it mischievously, it is their *ideas* which must be attacked and not the blessings of technology which must be delayed.

At the closing meeting of the Conference, Prof. H. Levy, of the Imperial College of Science and Technology, gave an address in which he sought to evaluate the part played by men of science and technologists in the present international situation. Since they have made possible the latest and most deadly means of war, he insisted that it is their duty to see where the application of their work is leading the world. They cannot, for example, shut their eyes to the experiments now being conducted in Spain and China. They have been brought up, he said, to believe that any contributions they make to scientific knowledge are to be regarded as a service to humanity. That is not true. The results of their work are at present being used to destroy humanity, and it is their duty to face up to that fact. They must learn, however, to watch such experiments as those in Spain and China unemotionally and with the same detachment as they regard an experiment in a laboratory. They must understand causes and effects, and to do that they must realize that, from man's first appearance, forces have been at work which have, at various stages in history, altered the economy under which society has been conducted. A feudal economy, for example, could not cope with new knowledge and it had to break up. The main forces which have driven man on through successive stages have been the discovery of new kinds of tools and the knowledge of new raw materials. These forces are more than ever at work. Technical men are producing a new technique. The new processes which are being discovered to control Nature are causing the stresses and strains, the wars and the revolutions which have been manifest since the end of the war in 1918. The man of science and the technologist, as individuals, can do little. But, if they see clearly what is happening and understand the significance of events and the part which their work is playing, they will discover the necessity for them to work through their groups and associations in order to save the world from disaster.

Pontifical Academy of Sciences

THE formal inaugural meeting of the second academic year of the newly reconstituted Pontifical Academy of Sciences (see NATURE, 140, 965; 1937) was held on January 30, 1938, in the presence of His Holiness Pius XI. The meeting, an account of which is contained in the Academy's *Acta* (2, Part 1, 1938), was held in the new hall which has been added to the Casina Pio IV, the Academy's headquarters in the Vatican gardens, through the generosity of the Pope. Besides a large proportion of the seventy academicians, there were present Church dignitaries and lay members of the Vatican Government, representatives of the Royal Italian Academy and of the Academy of the Lincei, and members of other Roman cultural and scientific bodies.

In his presidential address Father Gemelli, after paying tribute to the Pope's active and generous interest in the progress of science, surveyed the Academy's first year of existence. In addition to the publication of two large volumes of the

Commentationes and of the *Acta*, the Academy has instituted an inquiry among its members to determine what shall be its most useful function. The president emphasized that the Papal Academy differs from other national bodies of a similar nature in being truly international, since it contains members of many nationalities all of whom have equal rights and privileges. From the large number of replies to the president's inquiry, which are reproduced in the *Acta*, it would appear that there is a general desire that the Academy should not restrict its activities to the publication of individual scientific communications, but should take advantage of the freedom of action guaranteed by its scientific independence of race or creed to strengthen the bonds between the various sciences. The rules of the Academy have been the subject of further discussion by its council and members, and steps have been taken to ensure that in the election to vacancies in the membership the international character and the representation of the different sciences shall be maintained.

An annual prize, of the value of 25,000 lire, to be known as the Pius XI Prize, has been instituted. It may be awarded for any distinguished contribution to the progress of science made in the preceding ten years, either by a single important discovery or as a result of a series of systematic researches, or by a publication of great scientific interest. The president announced that the members of the Academy would shortly be called on to propose names for the 1938 award, which will be made for a distinguished contribution to the progress of biological science.

During the first year of its existence, the new Papal Academy has suffered the loss by death of three of its members, namely, Lord Rutherford, Paolo Luigioni, and the Marchese Marconi, and the main purpose of the inaugural meeting was to honour the memory of the last-named of these distinguished men of science. The Marchesa Marconi was present as an honoured guest at the ceremony. Guglielmo Marconi's immense contributions to physical science and to the development of wireless communication through space formed the subject of addresses by Prof. G. C. Vallauri of Turin, and Prof. W. F. Bjerknes of Oslo, both members of the Papal Academy. The latter, who is probably the sole surviving personal pupil of Heinrich Hertz, exhibited during his discourse the original 19-page manuscript entitled "Über elektrodynamische Wellen im Luftraume und deren Reflexion" in which Hertz described the first results of his experiments on electric waves. At the close of Prof. Bjerknes' address, Hertz's manuscript was examined by His Holiness with considerable interest. As was reported in *The Times* of March 26, 1938, the Pope's interest in this document (which was not, as reported there, presented by Prof. Bjerknes to the Papal Academy) found a practical expression in the personal gift of a sum of £250 to Hertz's widow, Mrs. Elizabeth Hertz, who is living in exile at Cambridge with her two daughters. The presentation of the gift was entrusted to Canon Marshall, of Cambridge, by Cardinal Hinsley, Archbishop of Westminster.

Pius XI, in his own address to the Academy, paid a personal tribute to the benefits conferred on mankind by the labours of Hertz and of Marconi, whose work, undoubtedly accompanied by Divine blessing, recalled the words of Schiller: "Soll das Werk den Meister loben, doch der Segen kommt von oben". The Pope also referred to his own deep-rooted interest in science and the search after truth—an interest which had in his own private life found an outlet in the love of Nature and a passion for the reading of books.

Oil from Coal

IN the December 1937 issue of the *New Zealand Journal of Science and Technology* (19, No. 7), there is an interesting article, initialed "W. G. H.," on the production of oil from coal as seen from an Australian point of view.

The process of low-temperature carbonization is dependent for commercial success largely upon the acquisition of a market for the semi-coke produced. Such a market is readily found in Great Britain, where the smoke nuisance from raw coal burned in the domestic grate is acute. In Australia, however, very little raw coal is burned in the cities and there is consequently no market for semi-coke in this direction. Low-temperature carbonization might be considered as a subsidiary method of providing coke for the Fischer Tropsch process of synthesis of hydrocarbons or to provide coke for hydrogenation.

Economically, hydrogenation is unsound from the Australian point of view. The estimated cost of a plant capable of producing 45,000,000 gallons of petrol per annum from bituminous coal is approximately £11,000,000 (Australian currency) and for one working on lignite it is nearly £12,000,000. Allowing for a return on capital of 6 per cent and for amortization in ten years, the cost would be 17*s*. 3*d*. per gallon from bituminous coal and 18*s*. 2*d*. per gallon from lignite. The Fischer Tropsch process is no more attractive economically than hydrogenation in Australia. It has been estimated that to produce petrol at 8*d*. per gallon from a plant with an output of 9,000,000 gallons per annum, a subsidy of £300,000 or £1,000 per man per annum would be required.

The above facts admittedly do not commend any of these processes in Australia, but there are other important factors which would have to be carefully considered before deciding whether or not to erect a coal conversion plant in the Commonwealth. The chief of these are future supplies and cost of flow oil; payment in Australian goods for foreign supplies; possible interruption of supplies in the event of war; storage problems; the likelihood of finding flow oil in the Commonwealth; and the value of a new industry as an employer of both direct and indirect labour.

All these contingencies must be assessed before any decision is taken to erect a plant which at best can only produce a local product to compete with an imported article at one third to one quarter of the cost.

Science News a Century Ago

Philip Kelland appointed to Edinburgh

ON June 20, 1838, *The Times* announced that Mr. Kelland had been appointed to the chair of mathematics in the University of Edinburgh. The vacancy had been caused through the resignation on account of ill-health of Prof. William Wallace (1768–1843), who had held the chair since 1819. Kelland was the son of a clergyman and was born at Dunster, Somerset, in 1808. Entering Queens' College, Cambridge, he graduated in 1834 as senior wrangler and Smith's Prizeman, and for three years was a tutor. He held the professorship at Edinburgh until his death on May 7, 1879. Among his writings were a "Theory of Heat", papers on the motion of waves, the article on algebra in the ninth edition of the "Encyclopædia Britannica" and an introduction to quaternions. At the time of his death he was president of the Royal Society of Edinburgh. As a teacher he was unequalled.

Wheatstone and the Stereoscope

THE meeting of the Royal Society held on June 21, 1838, was the last before the long vacation. One of the papers was by Whewell on tides, and another was by Wheatstone entitled "Contributions to the Physiology of Vision. Part I. On some remarkable and hitherto unobserved Phenomena of Binocular Vision". In his paper, Wheatstone showed that the perspective projections of an object upon the two retinæ differ according to the distance at which the object is placed before the eyes; if it be placed so distant that to view it the optic axes must be parallel, the two projections are precisely similar, but if it be placed so near that to regard it the optic axes must converge, a different perspective projection is presented to each eye, and these perspectives become more dissimilar as the convergence of the optic axes becomes greater. Notwithstanding this dissimilarity between the two pictures, which is in some cases very great, the object is still seen single, contrary to the very prevalent metaphysical opinion that the single appearance of objects seen by both eyes is owing to their features falling on corresponding points of the two retinæ. To illustrate some of his views, Wheatstone used an apparatus called by him a stereoscope.

The Newcastle and Carlisle Railway

AMONG the British railways opened in 1838 was that from Newcastle to Carlisle, a distance of sixty-one miles, which was inaugurated with much ceremony on June 18. Describing the event, the *Tyne Mercury* said: "The anniversary of the battle of Waterloo, which crowned the British arms with success and restored peace to Europe, was selected as the day on which to celebrate the event, and one of the engines is named *Wellington*. Different portions of the railway have been opened from time to time, and made available for the commerce of the north; but on Monday the whole line was passed over for the first time. The engines started in the following order:—First the *Rapid*, as an advanced guard and without any train, displaying the Union Jack, next the *Meteor* with four carriages and a flag on which was inscribed 'England expects every man to do his duty'. In this train we observed the mayor of Newcastle and his friends with the Allenheads band; then followed the *Victoria* with nine carriages, the *Wellington* with nine, the *Nelson* with seven, the *Lightning* with ten and the Carlisle band; next the *Tyne* with its steam organ and nine carriages; after these came the *Carlisle* with eight, the *Eden* with ten, the *Goliath* with nineteen and about 600 passengers, then the *Atlas* with seventeen, next the *Samson* with eleven. . . . The *Newcastle* with nine . . . followed by the *Hercules*, the last of the list, with eight carriages." The *Tyne Mercury* estimated that the trains carried more than 3,500 passengers, and the procession when in motion extended over one and a half miles.

Disease Among Troops in West Indies

IN a paper read before the Statistical Society on June 18, 1838, and published in the *Athenæum* of June 30, on the sickness and mortality among the troops in the West Indies, Mr. Henry Marshall, deputy inspector-general of hospitals, and Captain Tulloch came to the conclusion that many of the opinions hitherto entertained of the nature and influence of the causes of diseases in the West Indies must have been adopted on inadequate evidence, since it appeared that no uniform effects were produced by exposure to a high temperature, by excess of moisture, by the combined effects of high temperature and great moisture, by the absence of trade winds during the sickly season, by the supposed influence of miasma from the South American continent, or by the physical and geographical character of the soil. In the absence of all tenable and consistent theories to account for the high mortality of the white troops in the West Indies, the suggestion was made that experiments should be undertaken on the electrical condition of the atmosphere during epidemic periods, the development of electrical phenomena being known to be intimately connected with heat and moisture, and to exercise an influence on vegetation.

Electric and Crystalline Polarity

FARADAY'S first entry in his Diary for June 21, 1838, is: "Experimented on the effect of Polar arrangement of the particles of crystals on their specific inductive capacity, i.e., on their inductive capacity in different directions." The work thus begun evidently occupied him for the greater part of the summer, for the entries continue until August 14. The apparatus used was simple. Cubes of various crystalline materials, for example, Iceland spar and rock crystal, were cut with their faces parallel and perpendicular to the crystal axes. The cube under experiment was placed on a stand, and a brass ball, connected to a Leyden battery by which it was kept uniformly electrified, brought up to one face. The induction through the crystal was measured by means of a Coulomb torsion electrometer, the carrier ball of which was brought up to the opposite face.

A large number of measurements of the inductive capacity of the materials was made in directions parallel to and transverse to the crystalline axis, in the hope of detecting some difference. The experiments were afterwards described in the Fourteenth Series of the "Experimental Researches in Electricity", and although Faraday says that he "sought with great anxiety for a relation between electric polarity and that of crystallization", he came reluctantly to the conclusion that his results had "not established any connection of the kind sought for".

Retirement of Olinthus Gregory

IN its issue of June 23, 1838, the *Mechanics' Magazine* said: "We understand that Dr. Olinthus Gregory, who has for the long period of thirty-five years presided over the Royal Military Academy, Woolwich, with so much credit to himself and advantage to the public service, and whose numerous scientific works have contributed so much to the promotion of practical science, has been permitted to retire from the Professorship of Mathematics at Woolwich. He is succeeded in the professorship by Mr. S. H. Christie, Secretary to the Royal Society who took a high degree at Cambridge many years ago, and who has been connected with the Royal Military Academy, we believe, about 32 years."

Olinthus Gilbert Gregory (1774–1841), who was born in Huntingdonshire of humble parentage, owed his early training in mathematics to the Leicestershire botanist, Richard Weston (1733–1806). He was in turn sub-editor of a newspaper, a bookseller and a private teacher. Becoming known to Charles Hutton, the professor of mathematics at Woolwich, and the editor of the *Ladies' Diary*, in 1802 he was made a master in the Royal Military Academy and in 1807 succeeded to Hutton's chair. Among his contributions to science were his experiments on the velocity of sound. He was one of the projectors of University College, London, and his name was inscribed on the stone laid in Gower Street on April 30, 1827.

University Events

BIRMINGHAM.—The new Hospital Centre and Medical School are to be opened by the King and Queen on July 14, and to mark the occasion, at the degree congregation on July 2, the honorary degree of LL.D. is to be conferred on the following: Viscount Nuffield, who has contributed nearly £200,000 to the Hospital Centre; Mr. Harry Vincent, who besides being a generous supporter has given much time and energy to the working out of the scheme; Colonel Sir Bertram Ford, chairman of the Board of Management of the Birmingham Hospitals Contributory Association; Dr. Robert Hutchison, president of the Royal College of Physicians; Sir Cuthbert Wallace, president of the Royal College of Surgeons; and Sir Edward Mellanby, secretary to the Medical Research Council.

CAMBRIDGE.—Prof. Eileen Power, professor of economic history in the University of London, has been elected to an honorary fellowship at Girton College.

OXFORD.—In Convocation on June 14, it was agreed to confer the honorary degree of D.Sc. on Prof. C. G. Jung, professor of psychology at the Federal Technical University, Zurich, on July 30.

C. G. T. Morison, Christ Church, has been elected a member of the Hebdomadal Council.

H. B. Butler, All Souls College, has been appointed the first warden of Nuffield College.

SHEFFIELD.—Prof. Irvine Masson, professor of chemistry and head of the Department of Pure Science in the University of Durham, has been appointed vice-chancellor in succession to Dr. A. W. Pickard-Cambridge, who is retiring.

Dr. E. Leighton Yates has been appointed assistant lecturer in physics.

Societies and Academies

Dublin

Royal Irish Academy, May 23.

J. K. CHARLESWORTH: Some observations on the glacial geology of north-east Ireland. The chief theses of this paper are (1) the drumlins of north-east Ireland were fashioned by ice of the last main glaciation; (2) a Carlingford re-advance against the Mourne and Carlingford Mountains and along Carlingford Lough; (3) the southward retreat of the ice along the Main and Lower Bann and its stagnation along its front and in the Lough Neagh area; (4) an Antrim coastal re-advance that blocked the Bann and Lagan and ponded the drainage of the glens of Antrim in a suite of glacier-lakes.

H. S. W. MASSEY and R. A. BUCKINGHAM: Long-range forces between hydrogen molecules. The van der Waals' force between two hydrogen molecules in any fixed orientation is calculated.

Paris

Academy of Sciences, April 20 (*C.R.*, 206, 1209–1228).

LUCIEN DANIEL: Sudden or retarded ripening in the bean.

ANDRÉ HAARBLEICHER: The triangles of Poncelet.

MLLE. MARGUERITE QUINTIN: The hydrolysis of solutions of cadmium benzenesulphonate.

ANDRÉ MERCIER and TORSTEN GUSTAFSON: The true energy of the electron.

SERGE NIKITINE: Contribution to the theory of photodichroism.

HÉLIOS SCAETTA: The notion of a cycle in the evolution of tropical soil based on researches in central and in western Africa.

MME. RITA DUBERTRET, LOUIS DONCIEUX and LOUIS DUBERTRET: The Nummulitic of Koseir, to the south of Antioch (Syria).

VLADIMIR FROLOW: The annual component of the rains in Morocco.

April 25 (*C.R.*, 206, 1229–1272).

LUCIEN CAYEUX: The migration of phosphoric acid, following on the decalcification of the phosphatic chalks with *Belemnitella quadrata* in the north of France. The genesis of the phosphatic chalks and of the sands arising from their decalcification results from two totally different phenomena, an incomplete calcification causing an enrichment of the product and an addition of phosphate to the limestone which escaped solution.

ANDRÉ BLONDEL: An apparatus for comparing the luminous flux of sources of light.

GEORGES GIRAUD: Problems of the Dirichlet type.

JULES HAAG: Asymptotic formulæ concerning the oscillations of relaxation.

HENRI LAGATU and LOUIS MAUME: Measurements of agricultural biochemistry on the branches of the vine.

PAUL LÉVY: The definition of the laws of probability by their projections.

CHRISTIAN PAUC: Unification of the generator processes of various contingents and paratingents.

AYZYK GORNY: The maxima of the moduli of a function and of its derivatives.

JEAN MARIANI: A possible interpretation of the solar and terrestrial magnetic fields.

RAYMOND CHEVALLIER and MLLE. SUZANNE MATHIEU: Adsorption in the precipitation of hydroxide starting with ferric sulphate.

ANDRÉ MICHEL and MLLE. MARGUERITE GALLISSOT: The relation between the state of crystallization and the amplitude of the thermomagnetic anomaly of lepidocrocite.

MAURICE BAYEN: The measurement of the ultra-violet dispersion of water at temperatures between 6° and 35° C.

FRÉDÉRIC JOLIOT and IGNACE ZLOTOWSKI: The formation of an isotope ^{5}He during collisions between helions and deuterons. Description of experiments demonstrating the formation of the helium nucleus of mass 5·0106, stable towards the emission of a neutron.

ALBERT KIRRMANN and JEAN LICHTENBERGER: The structure of some halogen substituted aldehydes and of a methoxyl derivative.

V. M. MITCHOVITCH: The constitution of the quinaldinic acids.

MARTIN BATTEGAY and ROBERT KREBS: The thiolcarbamic esters (alkyl-S-thiourethanes) and their transformations into halides of alkylsulphonic acids.

EDOUARD LEGÉ: The transformation of oleaginous materials into mixtures of hydrocarbons.

ANDRÉ EICHHORN: Chromosomic enumeration and nuclear evolution in two *Tetrastigma* (Ampelidaceæ).

ANDRÉ KLING, NICOLAS SAMSSONOW and MME. MARGUERITE HEBOS: Primitive cancers of the lung produced in mice by light oils from coal tar.

Vienna

Academy of Sciences, February 17.

H. LICHTBLAU: Anomalies occurring in mass spectroscopy. On plates taken with the mass spectrograph of Mattauch and Herzog certain lines and bands are found which do not correspond with any ions. The origin of these 'ghost' lines is investigated.

K. PRZIBRAM: Coloration and excitation of fluorite and a new fluorescent material containing divalent europium. Europium oxalate fused with calcium chloride yields a fluorescent material with the colour of Weardale fluorite. A study of this suggests that all fluorites contain traces of divalent europium. Various degrees of partial reduction of the calcium ions by the europium correspond with the various colours found in Nature.

H. GÜNTERT: New Clariide from the Cameroons.

H. PRZIBRAM: Biochemistry of the antipathic substances in the anterior and posterior lobes of the hypophysis. The anterior lobe is found to contain adrenalin and the posterior lobe choline. Various commercial preparations of extracts of the hypophysis are also examined.

R. SCHUMANN: Latitude variations in 1936 and 1937. It is necessary to establish latitude measuring stations in high latitudes if reliable measurements of movements of the poles are to be made.

F. KERNER-MARILAUN: Influence of melted snow on the temperature of mountain springs. Measurements of the difference in temperature between spring waters and the ground, when correlated with the amount of snowfall in the neighbourhood, enable the course of the water from the melting snow to be traced through the rocks to the springs.

V. F. HESS, A. DEMMELMAIR and R. STEINMAURER: Relation between the intensity of the earth's magnetic field and cosmic rays.

O. AMPFERER: Tectonic conception of dead folds. Elimination of dead folds and formation of folds from unfolded layers.

February 24.

M. TOPERCZER: (1) Secular variation of the magnetic declination in Austria in the period 1930–1935. (2) The great magnetic storm on the occasion of the aurora of January 25, 1938.

March 3.

J. HOFFMANN: Permanganate ions in violet and reddish apatites. The colours of certain apatites are due to MnO_4 ions. The colour changes which occur on heating, irradiation, etc., are analogous to those which occur in 'chameleon mineral'.

A. KAILAN: Chemical action of radium radiation (21). Action on piperidine and quinoline.

H. HABERLANDT: Luminescence, absorption and arc spectra of fluorites and apatites.

F. E. SUESS: Formation of the Caledonians and Wegener's hypothesis.

E. SPÄTH and P. H. LÖWY: Cumarine-α-pyrone.

K. M. KREMANN and E. GASTINGER: Degree of depolarization of the scattered radiation of binary liquid mixtures.

M. PESTEMER, A. J. K. SCHMIDT, LOTTE SCHMIDT-WILIGUT and F. MANCHEN: Halochromism of perylene, its quinones and some of its substitution products.

H. TOLLNER: Aurora of January 25, 1938. The Zentralanstalt für Meteorologie und Geodynamik in Vienna has received 672 reports of observations of the aurora in Austria and neighbouring States. These are available for any men of science who may wish to study them.

March 10.

O. AMPFERER: Conception of tectonic leading lines.

D. v. KRIPP: Method for the measurement and graphical representation of organic systems.

Tokyo

Imperial Academy (*Proc.*, 14, No. 3, 87–124, March 1938).

SHIN-ICHI TAKAHASHI: An application of the Fourier transform to almost periodic functions.

KINJIRO KUNUGUI: On the projection of an ensemble plane *G* 8.

TOSIO KITAGAWA: Multiplication theorems of the Cauchy series.

HISASHI KIMURA: New observing programme for the International Latitude Service.

SHIGEO NAKAGAWA and INOSUKE SUMOTO: γ-Ray activity induced in cadmium by slow neutron bombardment.

AKITUNE IMAMURA: Crustal deformations as revealed through revisions of levels linking Hirosima with Sindi.

YASUHIKO ASAHINA and TUTOMU MOMOSE: A santonin derivative with immediate vermifugal action.

SHINKICHI YOSHIMURA and TOSIO WADA: Hydrogen sulphide and ferrous sulphide in the bottom deposits of the brackish water lake, Hamanako, Sizuoka Prefecture. The hydrogen sulphide in the black shale deposits determines the absence or poverty in population of fossils.

TEUCHI KOBAYASHI: A tectonic view on the Öga Decke in the inner zone of western Japan.

Forthcoming Events

Wednesday, June 22

SOCIETY FOR THE STUDY OF ALCHEMY AND EARLY CHEMISTRY (at King's College, Strand, London, W.C.2), at 7.30.—Dorothea W. Singer: "The Name of Plato in Chemistry".

INTERNATIONAL ENGINEERING CONGRESS, June 21–22, to be held at the Empire Exhibition, Glasgow.

SOUTH-EASTERN UNION OF SCIENTIFIC SOCIETIES, June 21–25.—Annual Congress to be held at Worthing.

June 21, at 8.—Dr. Julian Huxley, F.R.S.: "Natural History—Taxonomy and General Biology" (Presidential Address).

Friday, June 24

ROYAL COLLEGE OF SURGEONS OF ENGLAND, at 5.—Prof. John Beattie: Recent Work in Experimental Surgery" (Arris and Gale Lectures. Succeeding lectures on June 27 and 29.)

Appointments Vacant

APPLICATIONS are invited for the following appointments, on or before the dates mentioned:

DISTRICT FOREST OFFICERS and DISTRICT ESTATE OFFICERS to H.M. Forestry Commissioners—The Secretary, Forestry Commission, 9 Savile Row, London, W.1 (June 20).

ASSISTANT LECTURER IN ORGANIC CHEMISTRY and ASSISTANT LECTURER IN GEOLOGY in the University of Bristol—The Registrar (June 21).

PRINCIPAL of the Smithfield Meat Trades Institute, E.C.1—The Education Officer (T.1), County Hall, London, S.E.1 (June 25).

LECTURER IN ELECTRICAL ENGINEERING in the Denbighshire Technical Institute, Wrexham—The Director of Education, Education Offices, Ruthin (June 25).

LECTURER IN MATHEMATICS in the Bedford College for Women, Regent's Park, London, N.W.1—The Secretary (June 30).

LECTURER IN ENGINEERING (Strength of Materials) and TWO LECTURERS IN ELECTRICAL ENGINEERING in the Technical College, Derby—The Clerk to the Governors (June 30).

SENIOR LECTURER IN ELECTRICAL ENGINEERING in the County Technical College, Mansfield—The Principal.

BOTANIST in the Plant and Animal Products Department of the Imperial Institute—The Establishment Officer, Imperial Institute, London, S.W.7.

Reports and other Publications

(not included in the monthly Books Supplement)

Great Britain and Ireland

Empire Cotton Growing Corporation. Report of the Administrative Council of the Corporation submitted to the Seventeenth Annual General Meeting on May 25th, 1938. Pp. ii+60. (London: Empire Cotton Growing Corporation.) [305

S.C.R. Report on the 17th International Geological Congress, Moscow, 1937. By Dr. G. W. Tyrrell. Pp. 14. (London: Society for Cultural Relations with the U.S.S.R.) 2d. [315

Proceedings of the Royal Irish Academy. Vol. 44, Section A, No. 9: The Precession of the Inertial Frame of a Rotating Body. By W. J. van Stockum. Pp. 109–122. 1s. Vol. 44, Section B, No. 7: The Physiological Basis of the Sensation of Cold. 6: Excitability and the Oxygen Consumption of the Skin. By J. M. O'Connor. Pp. 129–140. 1s. Vol. 44, Section B, No. 8: The Dalradian Rocks of the Sperrin Mountains and Adjacent Areas in Northern Ireland. By J. J. Hartley. Pp. 141–172+3 plates. 2s. Vol. 44, Section B, No. 9: On the Irish Species of the Dipterous Family Phoridae. By Dr. H. Schmitz. Pp. 173–205+1 plate. 2s. (Dublin: Hodges, Figgis and Co.; London: Williams and Norgate, Ltd.) [315

Department of Scientific and Industrial Research. Report of Test by the Director of Fuel Research on the Morgan Rotary Retort installed at Rodridge Hall, near Wingate, County Durham. Pp. iv+22+1 plate. (London: H.M. Stationery Office.) 9d. net. [16

Scientific Proceedings of the Royal Dublin Society. Vol. 22 (N.S.), No. 1: Dissemination of Potato Viruses X and F by Leaf Contact. By J. B. Loughnane and Paul A. Murphy. Pp. 16. 1s. 6d. Vol. 22 (N.S.), No. 2: A Study of the Infiltration of Viruses into Seed Potato Stocks in the Field. By Phyllis Clinch, J. B. Loughnane and Paul A. Murphy. Pp. 17–31. 1s. 6d. (Dublin: Hodges, Figgis and Co.; London: Williams and Norgate, Ltd.) [16

Transactions of the Royal Society of Edinburgh. Vol. 59, Part 2, No. 9: The Structure and Function of the Alimentary Canal of Solid Molluscs, with a Discussion on their Nematocysts. By Alastair Graham. Pp. 287–308. 5s. Vol. 59, Part 2, No. 10: On some undescribed Species from the Lower Carboniferous Flora of Berwickshire; together with a Note on the Genus *Stenomyelon* Kidston. By Dr. Mary G. Calder. Pp. 309–331+2 plates. 3s. 6d. (Edinburgh: Robert Grant and Son, Ltd.; London: Williams and Norgate, Ltd.) [16

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